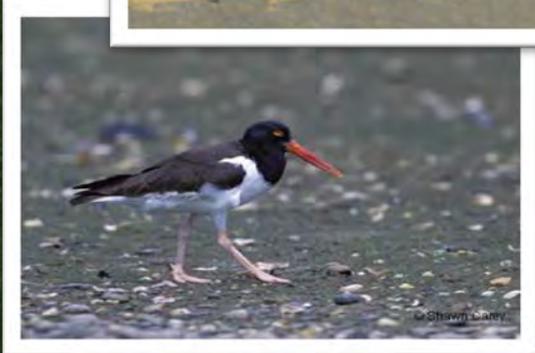




Shorebird Management Plan Environmental Assessment

November 2015



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**US Department of the Interior
National Park Service
Shorebird Management Plan / Environmental Assessment
Cape Cod National Seashore, Massachusetts**

Executive Summary

The National Park Service (NPS) proposes to develop an integrated, comprehensive, and adaptive approach to conservation and management of special status shorebirds within Cape Cod National Seashore (national seashore), while providing for recreational uses to the extent possible. The recent Standard Operating Plan (1994, updated in 2012) for the management of threatened and endangered shorebird species at the national seashore needs to be updated. This plan has guided national seashore efforts in protecting and managing shorebirds based on the best available information at the time it was prepared. However, it is no longer adequate because conditions have changed and current biological information provides a better understanding of the federal and state listed (threatened) piping plover (*Charadrius melodus*), the federal and state listed (endangered) roseate tern (*Sterna dougallii dougallii*), and the federal listed (threatened) red knot (*Calidris canutus rufa*), and other special status shorebirds.

This environmental assessment evaluates four alternatives to protect special status shorebirds and their habitats for breeding, feeding, and sheltering at the national seashore, including the no-action alternative (alternative A) and three action alternatives (alternatives B, C, and D). Alternative A (no action) would continue to implement the existing suite of practices for special status shorebirds at the national seashore as conducted in 2014. Alternative B (preferred alternative) would implement a comprehensive plan, accommodating most recreational uses with some restrictions that would include selective lethal predator selective removal of avian and mammal predators through an integrated predator selective removal program, greater protection for staging and migratory shorebirds, and flexible selective removal of piping plovers in areas of high use recreation. Alternative C offers similar protection and management of special status shorebirds and similar management of recreational uses as alternative A, but would also include selective lethal predator management of avian and mammal predators through an integrated predator selective removal program and a total ban on kiteboarding/kitesurfing throughout the national seashore. Alternative D would provide similar protection and management of special status shorebirds and similar management of recreational uses as alternative B, but with no lethal predator management.

This environmental assessment describes the environment and resources that would be affected by the alternatives and the environmental consequences of implementing these alternatives. The National Park Service identified alternative B, “Increased Protection and Flexible Management,” as the NPS preferred alternative because it would result in the most benefits to shorebirds by reversing current productivity declines while maintaining consistent and predictable access at specific high visitor use areas even with some additional recreational use restrictions related to shorebird protection.

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Note to reviewers and respondents: If you wish to comment on this environmental assessment, you may mail comments within 30 days to the name and address below or you may post them electronically at <http://parkplanning.nps.gov/caco>. Before including your address, telephone number, e-mail address, or other personal identifying information, you should be aware that your entire comment, including your personal identifying information, may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Superintendent, Cape Cod National Seashore Headquarters; 99 Marconi Site Road; Wellfleet, MA 02667

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Chapter 1: Purpose and Need

INTRODUCTION

The National Park Service (NPS) proposes to develop and adopt a new Shorebird Management Plan for Cape Cod National Seashore (national seashore) to replace a 2012 Standard Operating Plan that the seashore currently uses to manage and protect special status shorebirds and shorebird habitat within the national seashore.

The National Park Service has prepared this environmental assessment (EA) to assist in the decision-making process for developing and adopting a new Shorebird Management Plan for the national seashore. This environmental assessment evaluates four alternative strategies for shorebird management and discloses the likely environmental consequences of implementing the alternatives. This environmental assessment has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA) (42 *United States Code* [USC] 4321–4370), and its implementing regulations (40 *Code of Federal Regulations* [CFR] Parts 1500–1508), and with NPS Director’s Order 12: *Conservation Planning, Environmental Impact Analysis, and Decision-making* (2011), and accompanying NPS NEPA Handbook (2015).

BACKGROUND

The national seashore manages approximately 44,600 acres of uplands, wetlands, and tidal lands on Outer Cape Cod, Massachusetts (figure 1), including seaward to 0.25 mile offshore. The great Outer Beach is one of the last relatively undeveloped beachfronts in Massachusetts, is one of the largest expanses of contiguous beach on the east coast of the United States and provides important habitat for a wide range of wildlife including shorebirds.

The national seashore contains approximately 43 miles of beach, much of which is prime breeding, feeding, and sheltering habitat for beach-nesting and migrating shorebirds. Presently, approximately 33% of the Atlantic Coast population of piping plovers (*Charadrius melodus*) (591 pairs in 2010) nest in Massachusetts (USFWS 2011a) and the national seashore accounts for approximately 14% of the number of piping plover pairs in the state. The piping plover is a federally listed threatened species and is protected under the Endangered Species Act of 1973, as amended (ESA) (16 USC 1531 et seq.). The piping plover is also a state listed threatened species and is protected under the Massachusetts Endangered Species Act (MESA) (MGL c. 131A and its implementing regulations (321 CMR 10.00)).

The Northwest Atlantic roseate tern (*Sterna dougallii dougallii*) is both federally listed and state listed as endangered. The roseate tern population has experienced a 25% population decline since 2000, with fewer than 3,100 adult breeding pairs remaining (USFWS 2010). The national seashore provides some of the most important staging areas for roseate terns. A staging area is habitat used prior to or during bird migration for resting, feeding, and/or congregating. Staging areas on Cape Cod (Hadden 2001; Trull et al. 1999) and within the national seashore support approximately 75% to 85% of the Northwest Atlantic breeding population of roseate terns.



FIGURE 1. OVERVIEW OF CAPE COD NATIONAL SEASHORE

The red knot (*Calidris canutus rufa*) is federally listed as threatened. The North Atlantic region is important for red knots during both spring and fall migrations. The national seashore provides important staging and foraging habitat for red knots, especially during the southbound migration from July through September. From 2000 through 2014, flocks of up to 360 red knots were recorded at the national seashore. In addition, from 2008 through 2010, flocks of 350 to 1,000 red knots were recorded on Cape Cod, both at the national seashore and on adjacent lands including North and South Beach and sections of Pleasant Bay (unpublished field observations, USFWS, Eastern Massachusetts National Wildlife Refuge (NWR) Complex, MA).

In addition to the threatened and endangered piping plover, roseate tern, and red knot, the national seashore also provides habitat for many other nesting and migrating shorebirds, including other special status species.

PURPOSE OF AND NEED FOR ACTION

The purpose of the proposed action is to implement a comprehensive shorebird management plan to protect threatened and endangered and other special status shorebirds and their habitats for breeding, feeding, and sheltering at the national seashore. More specifically, the purpose of the proposed action is to achieve and maintain population recovery objectives (e.g., five-year weighted average productivity for piping plover, defined by the US Fish and Wildlife Service (USFWS) for federally listed, beach-nesting species); and to provide a suitable environment so that migrating species can rest and feed, relatively undisturbed, during migration while supporting recreational use to the extent consistent with achieving those goals.

Action is needed because changing conditions and new available information are not adequately addressed in current national seashore operations, and species recovery objectives are not being achieved. Since 2000, the “*five-year weighted average*” piping plover productivity in the national seashore has met the recovery goal in only 4 of 15 years and once in the past five years (2009–2014) resulting in a statistically significant, negative trend. A primary driver for this negative trend is an excessively high level of predation. The high level of predation is the result, in part, of human-caused factors such as bird feeders, garbage left on beaches, and animal road kills, which artificially increase predator populations because of the easily available and abundant food sources that subsidize predator populations. Once predators are attracted into an area by artificial food sources, they will also continue to prey on natural food sources such as shorebird eggs and chicks.

- Beach conditions and shorebird habitat at the national seashore have changed and continue to change seasonally and sometimes daily. New biological information and understanding concerning special status shorebird species have become available and new approaches to managing predator impacts have been developed and applied by various agencies. There have also been a number of management guidelines and policies developed that are meaningful to current shorebird management at the national seashore.

In addition, the federally endangered roseate tern, which is a migrant that spends up to several months resting and feeding at the national seashore, is not meeting recovery goals. Post-fledging survival during staging and migration (which occurs at the national seashore) may be limiting population recovery.

Lastly, red knots have experienced an 80% decline in populations over the past 10 years and are listed as federally threatened species. The importance of protecting staging sites along their mid-

summer and fall migration route (including at the national seashore) is critical to the recovery of red knots.

Current conditions and information need to be incorporated into an integrated, comprehensive, and adaptive management plan to conserve these special status shorebird species and to meet species recovery and other program objectives.

OBJECTIVES IN TAKING ACTION

Objectives are the goals that must be accomplished by taking action in order for the action to be considered a success. Objectives for this shorebird management plan must be grounded in the enabling legislation, purpose, and mission goals of the national seashore and must be compatible with the national seashore's General Management Plan (GMP) direction and guidance, NPS *Management Policies 2006*, and/or other NPS management guidance. All alternatives selected for detailed analysis must meet these objectives to a large degree and resolve the purpose of and need for action.

The new Shorebird Management Plan must meet the following objectives:

- Support the USFWS recovery goals for piping plover productivity.
- Provide an environment for increased productivity and contribute to state, regional, and national conservation goals for beach nesting, and staging and migrating shorebirds.
- Provide clear direction for day-to-day operations.
- Be adaptable to and sustainable in changing conditions over time.

The proposed shorebird management plan must also consider that the national seashore provides a variety of recreational activities for over four million visitors annually. Among the greatest attractions are the miles of ocean and bay beaches used for sunbathing, swimming, strolling, and sport fishing. Off-road vehicle (ORV) access is permitted along 8.5 miles of designated beach in Provincetown and Truro. While conservation of park resources remains predominant, the National Park Service is also mandated to provide for public enjoyment of the national seashore in a manner that leaves those resources unimpaired. Therefore, an additional objective of the new Shorebird Management Plan is to find a compatible management "balance" that achieves shorebird protection goals while accommodating recreational uses.

PURPOSE OF CAPE COD NATIONAL SEASHORE

The US Congress authorized Cape Cod National Seashore in 1961. According to the national seashore's General Management Plan, the authorization "*was an attempt to conserve a fragile and precious resource that overlays six established communities so that residents and visitors alike may enjoy it for generations to come.*" The national seashore purpose is to:

- *preserve the nationally significant and special cultural and natural features, distinctive patterns of human activity, and ambience that characterize the Outer Cape, along with the associated scenic, cultural, historic, scientific, and recreational values, as well as*
- *provide opportunities for current and future generations to experience, enjoy, and understand these features and values of both the natural environment and the cultural character of the Cape.*

LEGAL AND POLICY FRAMEWORK

The following laws, regulations, and policies provide mandates and direction for NPS management of shorebirds.

The National Park Service Organic Act of 1916

The National Park Service Organic Act of 1916, as amended (54 USC 100101 et seq.) created the National Park Service with the mission to ". . . *conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.*"

Redwood National Park Act of 1978, as Amended

All national park system units are to be managed and protected as parks, whether established as a recreation area, historic site, or any other designation. This act states that the National Park Service must conduct its actions in a manner that will ensure no "*derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress.*"

NPS Management Policies 2006

NPS *Management Policies 2006* (NPS 2006) sets the framework and provides the direction for actions of the National Park Service. Adherence to policies is mandatory unless allowed by enabling legislation, or waived or modified by the Secretary, Assistant Secretary, or the Director, or if a law directly and specifically directs an action contrary to NPS policy. Specific policies relevant to this management plan require NPS units to maintain plant and animal populations by preserving and monitoring natural abundances and diversity of species, preserving the processes that sustain them, restoring populations that have been reduced or extirpated by human activities, and minimizing human impacts on native species.

Section 4.4.1.1 *Plant and Animal Population Management Principles*, states that relative to migratory species, the National Park Service will adopt park resource preservation, development, and use management strategies that are intended to maintain the natural population fluctuations and processes that influence the dynamics of individual plant and animal populations, groups of plant and animal populations, and migratory animal populations in parks.

Section 4.4.2 *Management of Native Plants and Animals*, states the National Park Service may intervene to manage individuals or populations of native species only when such intervention will not cause unacceptable impacts to the populations of the species or to other components and processes of the ecosystems that support them. Management can be employed to protect rare, threatened, or endangered species. Management may remove plant and animal individuals if it meets specific park objectives.

Section 4.4.2.1 *NPS Actions That Remove Native Plants and Animals*, states the National Park Service will seek to ensure that animal removals will not cause unacceptable impacts on native resources, natural processes, or other park resources. Whenever the National Park Service identifies a possible need for reducing the size of a plant or animal population, the National Park Service will use scientifically valid resource information obtained through consultation with technical experts, literature review, inventory, monitoring, or research to evaluate the identified need for population management.

Section 4.4.4.2 *Removal of Exotic Species Already Present*, states that all exotic plant and animal species that are not maintained to meet an identified park purpose will be managed—up to and including eradication—if, (1) control is prudent and feasible, and (2) the exotic species interferes with natural processes and the perpetuation of natural features, native species, or natural habitats.

Section 4.4.2.3 *Management of Threatened or Endangered Plants and Animals*, states that the National Park Service will manage state and locally listed species in a manner similar to its treatment of federally listed species to the greatest extent possible. The National Park Service will determine all management actions for the protection and perpetuation of federally, state, or locally listed species through the park management planning process, and will include consultation with lead federal and state agencies as appropriate. The National Park Service also cooperates with other agencies, states, and private entities to promote candidate species conservation agreements aimed at precluding the need to list species and conduct actions and allocate funding to address endangered, threatened, proposed, and candidate species. The National Park Service will control detrimental nonnative species as necessary to maintain threatened and endangered plants and animals and the habitat they depend on.

Section 8.2 *Visitor Use*, states the National Park Service will provide for enjoyment of the parks and encourage visitor activities provided those forms of enjoyment are suited and appropriate to the natural and cultural resources found in the parks. Enjoyment of park resources and values is part of the fundamental purpose of all parks.

Endangered Species Act of 1973, as amended

The purposes of the Endangered Species Act include providing “*a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved.*” The US Fish and Wildlife Service administers the Endangered Species Act as it relates to threatened and endangered shorebirds and the National Park Service implements the act within the national seashore in consultation with the US Fish and Wildlife Service. The effects of any agency action that may affect

endangered, threatened, or proposed species must be evaluated in consultation with the US Fish and Wildlife Service (Section 7(a)(2) of the ESA). According to the Endangered Species Act, “*all Federal departments and agencies shall seek to conserve endangered species and threatened species*” and “[*e*]ach Federal agency shall...insure that any action authorized, funded, or carried out by such agency...is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical. . .” Implementing regulations that describe procedures for interagency cooperation to determine the effects of actions on endangered, threatened, or proposed species are contained in 50 CFR 402. Section 9 prohibits any taking of a listed species. The definition of “take” includes harass, harm, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. A notable component of this definition is the definition of harm. Harm in the definition of “take” means an act that actually kills or injures protected wildlife. Such actions may include significant habitat modification or degradation that actually kills or injures wildlife by significantly impacting essential behavioral patterns, including breeding, feeding, or sheltering. Harass can be defined as an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly impair normal behavioral patterns including breeding, feeding, or sheltering.

Migratory Bird Treaty Act

While the Endangered Species Act protects only species listed as endangered or threatened by the US Fish and Wildlife Service, the Migratory Bird Treaty Act, as amended (16 USC 703-712) (MBTA) protects all migratory birds and their nests from direct harm. The MBTA implements various treaties and conventions among the United States and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the MBTA, taking, killing, or possessing migratory birds is unlawful. The regulatory definition of “take,” as defined by 50 CFR 10.12, means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt hunt, shoot, wound, kill, trap, capture, or collect. Section 703(a) provides that “it shall be unlawful at any time, by any means or in any manner, to . . .take . . .any migratory bird, any part, nest, or egg of any such bird” that is protected under the migratory bird treaties to which the United States is a party. Unlike the Endangered Species Act, “take” under the MBTA does not include harm or harass in its definition. However, the MBTA does allow for the lethal take of some migratory bird species (e.g., crows) listed in 50 CFR 10.13 under depredation permits or depredation orders. “Take” can occur under the depredation order for blackbirds, cowbirds, grackles, crows, and magpies (50 CFR 21.43) established by the US Fish and Wildlife Service. Crows are also allowed to be lethally taken during migratory bird hunting seasons as established under guidelines developed by the US Fish and Wildlife Service and implemented by the Massachusetts Division of Fish and Wildlife (MADFW.)

Memorandum of Understandings between the National Park Service and US Fish and Wildlife Service

To meet Section 3 of Executive Order 13186, 66 *Federal Register* 3853, 2001 – “Responsibilities of Federal Agencies to Protect Migratory Birds,” a 2008 memorandum of understanding between the National Park Service and the US Fish and Wildlife Service was developed to outline a collaborative and proactive approach to promote the conservation of migratory bird populations. The memorandum of understanding includes partnerships and comprehensive planning strategies and conservation measures for breeding, migrating, or wintering habitats. In addition, in April 2010, the National Park Service signed a memorandum of understanding with the US Fish and Wildlife Service to strengthen coordination for migratory bird conservation. The memorandum of understanding

helps identify and implement strategies to complement and support existing efforts and facilitate new collaborative migratory bird conservation partnerships and comprehensive planning strategies for migratory birds under the MBTA.

Fish and Wildlife Coordination Act of 1956

The Fish and Wildlife Coordination Act (16 USC 661 et seq.) provides the basic authority for state and federal cooperation and coordination in the area of fish and wildlife conservation. State and federal agencies have implemented cooperative agreements for a variety of fish and wildlife programs on federal lands. Appropriate topics for such cooperative agreements include, but are not limited to: animal damage management, endangered and threatened species, management activities involving fish and wildlife, and disposition of fish and wildlife taken in conjunction with the activities listed in this paragraph.

Superintendent's Compendium

The Superintendent's Compendium provides a concise written document with all of the special designations, closures, public use limits, and permit requirements imposed under the discretionary authority of the national seashore superintendent (36 CFR Parts 1–7 for Cape Cod National Seashore). The Superintendent's Compendium provides park-specific regulations in addition to 36 *Code of Federal Regulations*. It is the mechanism that has been used, and will continue to be used, to inform the public of the protective measures for shorebirds including restrictions on aerial recreational activities, vehicle use, pets, pedestrian access, horseback riding, and ORV corridor access. These restrictions and closures can change from year to year.

SPECIES RECOVERY PLANS, GUIDELINES, AND OTHER CONSERVATION PLANS

The national seashore also consulted the plans and resources below during refinement of management objectives and strategies:

Piping Plover Recovery Plan and Five-Year Review

The *Atlantic Coast Piping Plover Recovery Plan* was published in 1988 and later revised in 1996 (USFWS 1996). A five-year review was completed in 2009 (USFWS 2009a). The primary objective of the revised recovery program is to remove the piping plover population from the USFWS List of Endangered and Threatened Wildlife and Plants by: (1) achieving well-distributed increases in numbers and productivity of breeding pairs, and (2) providing for long-term protection of breeding and wintering plovers and their habitat. The recovery plan delineates four recovery units within the population: Atlantic Canada, New England, New York-New Jersey, and southern (Delaware, Maryland, Virginia, and North Carolina). Recovery criteria established within the recovery plan defined population and productivity goals for each recovery unit, as well as for the population as a whole. The recovery plan states:

A premise of this plan is that the overall security of the Atlantic Coast piping plover population is profoundly dependent upon attainment and maintenance of the minimum population levels for the four recovery units. Any appreciable reduction in the likelihood

of survival of a recovery unit will also reduce the probability of persistence of the entire population (USFWS 1996).

The national seashore falls within the New England Recovery Unit, which has a population goal of 625 breeding pairs (maintained for five years) and a five-year average productivity goal of 1.50 chicks fledged per pair (USFWS 1996, 2009a). The *U.S. Shorebird Conservation – North Atlantic Regional Shorebird Plan* endorses these goals (Brown et al. 2001; Clark et al. 2000). To maintain a stationary population within the New England Recovery Unit, an estimated productivity of 1.21 chicks fledged per pair is needed, based on regression analysis (Hecht and Melvin 2009). This value is similar to 1.24 chicks fledged per pair that was estimated through population modeling from the Massachusetts banding studies in the 1980s (Melvin and Gibbs 1996 as cited in USFWS 2009a). The five-year review supports effective integrated predator management and the development of agreements to ensure long-term protection and management that will maintain population targets and productivity (USFWS 2009a).

The 1996 Revised Recovery Plan provides guidance to beach managers and property owners to avoid potential violations of Section 9 of the Endangered Species Act and its implementing regulations (50 CFR 17) that could occur as the result of recreational activities on beaches used by breeding piping plovers along the Atlantic Coast. The 1996 Revised Recovery Plan provides management options that will prevent direct mortality, harm, or harassment of piping plovers and their eggs due to recreational activities. The National Park Service generally follows the 1996 Revised Recovery Plan for various elements of piping plover management such as protective fencing, vehicle management, pets on the beach, and other recreational activities to protect piping plovers and their eggs from harm or disturbance.

Roseate Tern Recovery Plan and Five-Year Review (Northwest Atlantic Population)

The *Roseate Tern Recovery Plan* was published in 1989 and later revised in 1998 (USFWS 1998). A five-year review was completed in 2010 (USFWS 2010). The primary objective of the recovery program for the roseate tern is to promote an increase in breeding populations, distribution, and productivity so that this species can be reclassified as threatened and eventually delisted. The updated recovery plan actions include: (1) increasing roseate tern survival and productivity by overseeing breeding roseate terns and their habitat, (2) developing a monitoring plan for wintering and migration areas, (3) obtaining unprotected sites through acquisition and easements, (4) developing outreach materials and implementing education programs, (5) conducting scientific investigations that will help facilitate recovery efforts, and (6) annually reviewing recovery progress and revising recovery efforts as necessary. The five-year review identified a lack of available information about distribution, movements, or ecology during the staging or migration period. It recommends that a better understanding of the habitats used by roseate terns during the post-breeding staging period should be developed and that the factors limiting the use of preferred sites should be addressed. Further it recommends that any ongoing conservation activities should continue. The Roseate Tern Recovery Team working group is currently evaluating how and where losses are suppressing the roseate tern population, as well as available and needed information for fall/winter migration and analysis of banding return data (S. von Oettingen, USFWS, pers. comm. 2015).

EXISTING CAPE COD NATIONAL SEASHORE MANAGEMENT PLANS

The 1998 Negotiated Regulations (1998 Neg Regs) for Off-Road Vehicle Use at Cape Cod National Seashore (NPS 1997a) (36 CFR, Part 7 – Special Regulations, Areas of the National Park System, Section 7.67 – Cape Cod National Seashore) amended the national seashore 1985 ORV Plan (NPS 1985). The piping plover was listed as threatened under the Endangered Species Act the year after the 1985 ORV Plan went into effect. Because of a lack of flexibility in the 1985 ORV Plan, there was an inability to adapt it to changing natural resource concerns. The piping plovers had dramatically increased their annual nesting activity within the existing ORV corridor. The 1998 Neg Regs revised the existing regulation of ORV use at the national seashore as an attempt to manage ORV access on the outer beach in a way that accommodates use by ORV enthusiasts and those choosing other forms of beach use, while minimizing impacts to natural and cultural resources and providing a degree of flexibility for managing the beach.

The 2007 Options for Managing ORV Access Plan (NPS 2007a and NPS 2007b). The 2007 Options for Managing ORV Access Plan addressed modifications of the 1998 Neg Regs guiding management of ORV access to the beaches of the national seashore. The plan adjusts the dates, times, and locations that ORVs are allowed to access the beach. The plan also stipulates that management would not invoke the option to modify ORV access unless there was a near or total closure of access to the existing ORV corridor as currently managed. The plan provides up to 0.5 mile of ORV corridor to avoid near total closure of ORV access to the beach.

The 1998 Cape Cod National Seashore General Management Plan (NPS 1998b) reflects a systematic approach to park management whereby recreational use and development are balanced with the need to ensure long-term preservation of natural resources, processes, and values. The 1998 General Management Plan states the National Park Service commitment to ensuring that national seashore management is:

... consistent with the protection of rare, threatened, or endangered species listed by or proposed for listing by the state or Federal government. In accordance with the ESA of 1973 and NPS policies, the NPS will work with the USFWS, the Massachusetts Natural Heritage Program, towns, and groups such as the Native Plant Conservation Program to protect and manage such species. Where information is available, work will be undertaken to restore native species lost because of human intervention. State authorities will be regularly contacted to update inventory lists and to consult on all activities that may affect state-listed species. . . .As needed, special management plans will be prepared for listed and proposed species. These plans will include assessments of existing and proposed management actions as they might affect a species. Species listed by the state and Federal government will be protected at a similar level throughout the seashore, regardless of management zones. To protect or manage listed threatened or endangered species, human access will be maintained to the extent possible for an area and will be consistent with the management needs of that species.

SCOPING

Scoping is an early and open process to determine the breadth of environmental issues and alternatives to be addressed in the environmental assessment. Scoping is used to identify which issues need to be analyzed in detail and which can be eliminated from in-depth analysis. Scoping is conducted both internally, with appropriate NPS staff and agencies with jurisdiction by law or

special expertise, such as the US Fish and Wildlife Service and Massachusetts State Historic Preservation Office (SHPO); and externally with interested and affected organizations and the public.

Public scoping was conducted from May 26 to August 5, 2011, and resulted in a broad range of ideas and alternatives for the management of shorebirds (see chapter 5). Issues related to the management of shorebirds at the national seashore identified through the scoping process included enhancing protection, reducing habitat loss, improving habitat, establishment of specific nesting and nonnesting areas, recognizing the importance of breeding stages and life cycles, and whether or not shorebird protection takes precedence over visitor use. Comments indicated both support of and opposition to the use of lethal strategies to control predators that target nesting and fledging shorebirds. Exhaustion of all nonlethal methods to control predators prior to the use of lethal methods was suggested. Concerns were also raised for the disturbance caused by kites and kiteboarding, recreational beach walkers, dogs, fishermen, and other users of beach and dune habitats. Comments received supported more, less, or no ORV/self-contained vehicles ([SCV]; a motor home or truck with an attached camper shell, with permanently mounted separate holding tanks for black and gray water storage), beach access, and use. A few commenters expressed concern that beach closures for protecting shorebirds would have an economic impact to the local economy.

IMPACT TOPICS

Impact Topics Retained for Detailed Analysis

Based on the issues raised during scoping, the following impact topics were retained for detailed analysis:

- Shorebirds (Special Status Species)
- Predator Species
- Visitor Experience and Recreation Opportunities
- Socioeconomics

Impact Topics Dismissed from Detailed Analysis

The following impact topics were initially considered but were subsequently dismissed from analysis. In each case, it was determined that the impact topic did not warrant detailed analysis for the reason(s) outlined.

Floodplains and Wetlands. The action alternatives evaluated in this environmental assessment that protect ocean and bayside threatened, endangered, and species of concern habitat and populations, are dependent on the habitat being within areas of the 100-year flood; however, none of the alternatives would add any structures to the floodplain that would result in a change in the ability of the floodplain to convey water; neither would any of the alternatives elevate the areas above the floodplain or reduce the capacity and function of the floodplain. Therefore, the impact topic of floodplains was dismissed from further analysis.

Cultural Resources. The National Park Service categorizes cultural resources as archeological resources; museum collections; submerged cultural resources; ethnographic resources; cultural

landscapes; and historic buildings, structures, and districts. None of the alternatives include actions that would have an effect on known archeological resources in the project area. None of the alternatives include activities in off-shore waters that would affect submerged cultural resources. None of the alternatives include actions that would change or remove cultural landscape features or intrude on the landscape setting nor do the alternatives include actions that would change or remove any building or structure, or district features or intrude on the historic setting. No museum collections would be affected under any of the alternatives and there are no known ethnographic sites in the project area. For these reasons, cultural resources were dismissed from further analysis.

Indian Trust Resources and Sacred Sites. Secretarial Order 3175 requires that any anticipated impacts on Indian Trust resources from a proposed project or action by the US Department of the Interior (USDI) agencies be explicitly addressed in environmental documents. There are no known Indian Trust resources in the project area and the remaining land and water comprising the national seashore. Therefore, the impact topic of Indian Trust resources and sacred sites were dismissed from further analysis.

Environmental Justice. Executive Order 12898, “General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing the disproportionately high and/or adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The impact topic of environmental justice was dismissed from further analysis for the following reasons:

- The national seashore staff and planning team solicited public participation as part of the planning process and gave equal consideration to all input from persons regardless of age, race, income status, or other socioeconomic or demographic factors.
- Implementation of the proposed action would not result in any identifiable adverse human health effects. Therefore, there would be no direct or indirect adverse impacts on any minority or low-income population.
- The impacts associated with implementation of the proposed action would not disproportionately affect any minority or low-income population or community.
- Implementation of the proposed action would not result in any identified effects that would be specific to any minority or low-income community.

Chapter 2: Alternatives

INTRODUCTION

This section describes the four alternatives (three action alternatives and the no-action alternative) that were considered reasonable and feasible to meet the NPS-defined purpose and need and objectives (see chapter 1). Only those alternatives determined to have potential for meeting the objectives were included for full evaluation in this environmental assessment. Other alternatives and actions that were eliminated from detailed analysis are described in table 1, including the reasons they were eliminated. A summary table of the key features of each alternative can be found in appendix G in this document.

DEVELOPMENT OF ALTERNATIVES

The alternatives described in this chapter were developed through a multiyear process that included opportunities for both agency and public input. At the start of this planning process, the National Park Service solicited input from the public, towns, park staff, government agencies, tribal officials, and other organizations for input on key issues and concerns for shorebird management at the national seashore.

An interdisciplinary planning team of national seashore staff reviewed and considered comments received during the 2011 scoping period. From these comments, professional judgment, and understanding of applicable laws, and through new information, lessons learned, and regional office guidance, the interdisciplinary planning team, in consultation with the US Fish and Wildlife Service, identified the key concepts and management approaches that would be necessary in the alternatives to meet objectives defined in the purpose and need. Using varied information, studies, reports and input, the interdisciplinary planning team identified key aspects of shorebird management that needed to be addressed in the management plan, including fencing and buffer zones, flexible management, other protection measures and use restrictions, and selective predator management.

The interdisciplinary planning team then developed four alternative approaches for managing shorebirds to achieve the desired outcomes stated in the purpose and objectives, and allowing for public access to the extent possible. The main differences between these alternatives lie in predator management and use/area-access restrictions.

ACTIONS COMMON TO ALL ALTERNATIVES

There are some actions, current practices, and policies for managing shorebirds or other related resources within the national seashore that would continue to be implemented regardless of which alternative is selected. These actions, practices, and policies include:

1996 U.S. Fish and Wildlife Service Piping Plover (Charadrius melodus), Atlantic Coast Population, Revised Recovery Plan (USFWS 1996a), Appendices F and G (Guidelines for the Use of Predator Exlosures to Protect Piping Plover Nests and Guidelines for Managing Recreational Activities in Piping Plover Breeding Habitat on the U.S. Atlantic Coast to Avoid Take under Section 9 of the Endangered Species Act, respectively)— National seashore shorebird management operations would follow these guidelines.

Shorebird Management Along the Pole Line Road (re: Vehicle Access to Race Point Lighthouse)— Vehicle access would be permitted in accordance with the 2007 *Race Point Lighthouse Essential Vehicle Management Plan* developed by the US Coast Guard (USCG) and the American Lighthouse Foundation (ALF). Under this plan, shorebird management would be adapted to allow for limited vehicle access to the Race Point Lighthouse during the piping plover nesting season; although, there are times when the national seashore would close the Pole Line Road to all ORV use due to, for example, flooding or shorebird activity.

Nest Searching and Monitoring— During the piping plover nest location phase (mid-April), the national seashore shorebird staff would search the beach regularly for adult plovers, nests, and plover tracks in the sand. Increased vigilance would be given to those areas that are not symbolically fenced to ensure nesting activity is identified and protected by fencing, when necessary. Symbolic fencing involves placing 5- or 6-foot (1.5 or 2-meter) wooden posts approximately 40–50 feet (12–15 meters) apart, connected by a line of cotton twine to delineate habitat. “Area Closed” signs are affixed to every second or third post. To provide accurate predictions of hatching dates, most beaches would be monitored daily to find nests before clutch completion. All incomplete piping plover nests would be checked on most days until clutch (egg-laying) completion. When complete, nearly all other piping plover nests throughout the national seashore would be monitored daily and no less than every other day. Nest locations would be documented by using a geographic positioning system (GPS) receiver to record the x/y coordinates, field observations, and other pertinent information to incorporate into the national seashore geographic information system (GIS) and shorebird management databases.

Following clutch completion, shorebird staff would monitor enclosed nests (nests that have been enclosed within wire mesh “cages” to protect adults, eggs, and newly hatched chicks from predators, see figures 2 and 3 under no-action alternative) every few days to check for predation/adult plover mortality and ensure that the openings at the base of the enclosure are exposed. On alternate days, these nests would be checked from a distance. Unenclosed nests would be monitored from a distance and approached less frequently to reduce any human scent or visual clue that might attract predators.

To ensure that chicks are found immediately after hatching, nests along the ORV corridor would be checked twice daily starting 25 days after nest completion. Nests outside the ORV corridor are usually checked daily starting 25 days after nest completion.

As standard monitoring procedure, shorebird staff visually estimates the colony size of terns from outside the symbolic fencing several times per week. Shorebird staff may walk inside the tern colony one to two times per week to count nests and/or chicks. To predict hatching dates of tern nests in the ORV corridor, terns would be monitored more frequently to find nests before clutch completion. Colony/nest locations would be documented by using GPS receivers and incorporated into the national seashore GIS and shorebird management databases. The main defense of least, common, and arctic terns is to “dive-bomb” and defecate on perceived threats (e.g., humans, pets, predators, etc.) that approach the colony, making it relatively easy to identify active tern nesting sites.

Shorebird staff also searches the beach for American oystercatcher (*Haematopus palliatus*) nests and tracks in the sand. Areas of the national seashore with oystercatcher nests are monitored most days. These nest locations would also be documented by using GPS receivers and incorporated into the national seashore GIS and shorebird management databases.

Brood Monitoring— All piping plover chicks would be monitored daily on most beaches, noting their movements, location, and number in each brood. Broods near open ORV corridor sections

would often be monitored twice a day, in the mornings and evenings, to ensure that there is an adequate protective buffer between the flightless chicks and ORVs.

Least, common, and arctic terns outside the ORV corridor would be monitored several times/week noting general number of chicks and locations. Tern chicks in the ORV corridor would be monitored daily, noting their movements, location, and number in each brood.

American oystercatcher chicks would be monitored daily, noting their movements, location, and number in each brood. If a brood nests in an open ORV corridor section, shorebird staff would monitor the brood twice a day, in the mornings and evenings.

Roseate Terns, Red Knots, and other Staging / Migrating Bird Monitoring—As part of a long-term roseate tern post-breeding study within the United States, researchers from the US Geological Survey (USGS) and Massachusetts Audubon Society conduct counts of staging terns and survey for color-banded roseate terns along national seashore beaches from mid- to late-July until the middle of September. From the beginning of July through mid-October, national seashore staff would assist in these surveys of staging terns when time allows, and further, conduct national seashore-specific surveys of these staging/migrating birds. In addition to collecting data on location, flock size, composition, and movement, national seashore staff and researchers would document disturbances to staging and migrating shorebirds from dogs, pedestrians, over-sand vehicles, and boats. For banded shorebirds, staff would make an effort to read the bands (resight) and report them to the appropriate monitoring agencies. In 2014, a more detailed, multiagency, three-year study on the importance of the national seashore to staging roseate terns was initiated.

The national seashore provides essential staging and foraging habitat for red knots, which are present in greatest numbers during migration (mid-July through September), using sandy ocean beaches and tidal mudflats to feed and rest. Generally, shorebird staff would not specifically search for red knots, but rather observe and record them when performing daily fieldwork activities. When red knots are observed, data on location, flock size, composition, and movement would be recorded. This general type of baseline data collection also occurs for other species/flocks of migrating shorebirds.

Determining When Chicks Have Fledged—Shorebird staff would determine that a piping plover chick has fledged if it is observed in sustained flight of at least 49 feet (15 meters). Broods less than 35 days old that appear “flight ready” (i.e., flight feathers fully developed) would be monitored closely, especially in the ORV corridor for flight distance by the shorebird staff once per day.

For broods more than or equal to 35 days old, shorebird staff would test the chicks no more than twice daily to determine if chicks meet the flight criteria. The ORV corridor may be re-opened when, at the discretion of the shorebird staff, all unfledged chicks have moved out of the area or have not been observed for five consecutive days.

Shorebird staff would determine that a least tern chick has fledged when it is observed in sustained flight of at least 49 feet (15 meters) as outlined in 1993 state guidelines. Rearing or nursery areas used by unfledged or recently fledged tern chicks would be delineated with protective fencing. Vehicle access would be managed in and around tern nursery areas while unfledged or recently-fledged tern chicks are present in these areas. It is important to note that tern nursery areas are not always located at nest sites.

American oystercatchers typically require 35–45 days to fledge but, adult oystercatchers often stay with fledged chicks until 60 days old. Shorebird staff would determine that an American

oystercatcher chick has fledged when observed in sustained flight of at least 328 feet (100 meters). For broods more than or equal to 45 days old, shorebird staff would test the chicks no more than twice per day to determine if chicks meet the flight criteria. Shorebird staff may consider the chick's behavioral response to vehicles when determining fledging. The ORV corridor may be re-opened when all unfledged chicks have moved out of the area or have not been observed for five consecutive days.

Under all alternatives, when these fledging criteria are met, national seashore staff would lift any fledgling restrictions placed on recreational uses.

Interdivisional Communication/Weekly and Annual Reporting— Shorebird management requires frequent communication among all the national seashore divisions. During the shorebird season, weekly interdivisional meetings among key field staff are held to communicate about shorebird nesting migrating/staging activity and related management activities. A weekly shorebird activity report is also transmitted to national seashore employees. An annual report summarizing shorebird activity and management is prepared, forwarded to appropriate NPS, USFWS, and state personnel and posted on the national seashore webpage for public dissemination. In addition, annual census statistics on breeding piping plovers, least terns, and American oystercatchers are summarized and shared with the Massachusetts Natural Heritage Program following the end of the nesting season.

Education, Outreach, and Public Involvement— Educating the public about the natural history, biology, and threats to nesting and staging shorebirds is important for increasing public understanding and gaining support for shorebird management that would foster public stewardship and help facilitate shorebird recovery. National seashore interpretation, education, and shorebird management staff would collaborate on program development by selecting informative messages, and providing a variety of media/delivery methods to communicate with the public.

- Concessioners, permit holders, summer seasonal employees, volunteers, contractors, and partners would be required to be briefed on shorebird protection measures, trash management, and impacts of feeding wildlife.

Shorebird Management on Non-NPS Land within the National Seashore— The protection and management of shorebirds within the national seashore is complex, due in part to the matrix of private, federal, and town ownership within the legislated boundary. This ownership pattern results in varying beach management practices including the level of resource protection and the associated laws. The lack of continuity in beach regulations, signage, and management between the various landowners within the national seashore boundaries has created a complicated and sometimes confusing situation for the general public and recreationists who may not differentiate between land ownership.

In recent years, there has been an increased effort in communication and coordination between the national seashore, neighboring towns, and private landowners regarding shorebird management. Historically, a small number of piping plover and/or least terns have nested on non-NPS land within the national seashore. As a courtesy and at the request of the landowners, the national seashore managed some of these additional nesting sites. The national seashore would manage small sections of beach with nesting piping plovers for the towns of Wellfleet and Truro. The towns agreed to adopt management practices used by the national seashore to protect piping plovers and other nesting shorebirds and provide signage. In addition, the national seashore shorebird staff would contact the town conservation officer to require logs of any administrative (i.e., emergency) use of vehicles in areas with unfledged special status species shorebird chicks. Regular communication,

including several site visits between town managers and the national seashore staff, would continue. Some towns, for example, Orleans and Chatham would continue to take the lead role in the protection and management of nesting, staging, and migrating shorebirds to USFWS standards on town-owned lands within the national seashore boundaries unless they request the National Park Service to provide management and protection.

The national seashore would mail letters in early spring to all owners of private beach parcels within the national seashore boundaries to inform them of private landowner responsibilities under state and federal law and to offer assistance in managing shorebirds and suitable habitat. Requests from towns or private landowners for assistance with managing habitat and nests would be evaluated on a case-by-case basis. The following actions would take place if the national seashore agreed to oversee shorebird management on these neighboring lands.

The landowners would support national seashore shorebird protection and management practices, which would be provided if the need arises. Effort would be made to accommodate any reasonable requests made by the landowners within staffing and funding availability. National seashore staff would work closely with the landowners to provide regular updates throughout the nesting season.

- *Archeological Resources*— Should archeological resources be uncovered during fencing or other ground-disturbing activities, work would be halted in the area and the NPS archeologist, state historic preservation office, and appropriate American Indian tribes (if applicable) would be contacted for further consultation.

ALTERNATIVE A: NO ACTION

Under the no-action alternative, the National Park Service would continue current procedures for managing and protecting shorebirds. Under the no-action alternative, the national seashore staff would continue to implement existing separate policies, programs, and updated guidance. The primary management procedures are defined in the existing standard operating procedure, which was developed in 1994 and revised and updated in 2012. The standard operating procedure describes management tools and actions, including symbolic fencing and buffer areas, flexible management, use restrictions, predator management, and other protection measures. These current shorebird management actions are described in more detail below.

SYMBOLIC FENCING AND BUFFERS

Symbolic fencing is used to identify and protect shorebird nesting and staging habitat (depending on the season) and provide a buffer between the birds and human disturbance. Five- or 6-foot (1.5- or 2-meter) wooden posts would be used and placed approximately 40–50 feet (12–15 meters) apart, connected by a line of cotton twine to delineate habitat. Plastic and wooden “Area Closed- Bird Use Area” informational signs would be affixed to every second or third post.

The national seashore would establish symbolic fencing and appropriate buffers and evaluate the need for beach closures pertaining to shorebird nesting activity based on biological and management criteria and policies. Decisions regarding the need for symbolic fencing, buffers, and beach closures would be made by the Division of National Resource Management and Science on a case-by-case basis; however, decisions would be made with input from Visitor and Resource Protection personnel and staff from other park divisions. Although protection of shorebirds would be the primary consideration, the effects of these decisions on recreational activities and visitor safety would be evaluated.

A buffer is the distance between the shorebird activity and the fenceline. Protection of shorebirds to breed, feed, and shelter would continue to be the primary considerations. Informational and regulatory signs and symbolic fencing would be installed around most suitable piping plover nesting habitat in high visitation area. In some areas where fencing in the intertidal area is necessary, symbolic fencing may be signs/posts without string.

The amount of fencing and timing varies from year to year, but approximately 27 miles of beach that is suitable shorebird habitat in the national seashore is being symbolically fenced each year.

Symbolic fencing would be installed around most piping plover suitable habitat by April 1 of each year, or soon thereafter, regardless of shorebird activity. Areas of nesting shorebird (piping plover, tern, or oystercatcher) habitat that have been symbolically fenced would be carefully monitored as part of the national seashore normal monitoring program. If no nesting birds, eggs, or chicks are present, fencing specific to nesting piping plover, tern, or oystercatcher protection would be reduced or removed starting on July 1. However, fencing may remain in some of these areas for continued shorebird protection needs including for breeding, feeding and resting. Symbolic fencing would be removed by mid-October once the majority of the migratory species have migrated south.

Symbolic Fencing of Life-Guarded Beaches

With concurrence from the US Fish and Wildlife Service, starting in 2012, four life-guarded beaches (Coast Guard Beach in Eastham, Nauset Light, Marconi Beach, and Herring Cove) were not symbolically fenced early in the season (by April 1) for a total length of 3,960 feet (0.75 mile or a little over 1.0 km) to allow for consistent recreational/pedestrian use of these beaches. Shorebird staff closely monitors these sections of beach and would erect symbolic fencing if or when a concentration of piping plover tracks or territorial or courtship behavior is observed; or these sections of beach would be considered for flexible management (see below).

Symbolic Fencing of ORV Corridors

ORV access is permitted along a designated beach corridor in Provincetown and Truro. Management of ORV access along the corridor would be based on the 1998 Neg Regs.

Piping plover management in areas open to ORVs would continue in accordance with the procedures in the “Motor Vehicle Management” section of the 1996 *USFWS Piping Plover Atlantic Coast Population, Revised Recovery Plan*. The 1996 USFWS Guidelines outline dates and criteria for the protection of nesting plovers in areas open to ORVs. Protection measures include the installation of symbolic fencing, vehicle restrictions, and monitoring efforts needed for different vehicle access scenarios. Areas not yet opened to ORVs would be managed in accordance with the procedures in the “Management of Non-motorized Recreational Uses” section of the 1996 *USFWS Piping Plover Revised Recovery Plan*. If these areas become opened to ORVs, the “Motor Vehicle Management” procedures would be implemented. Similar to other ORV operators, dune tour operators would be subject to all closures for shorebird activity. Details on both the nonmotorized and motorized vehicle management are discussed below.

All piping plover suitable habitat on Hatches Harbor Spit would be symbolically fenced, likely closing the area to vehicle use. Most suitable habitat on beaches where the ORV corridor exists would be symbolically fenced by April 1, or soon thereafter in accordance with the 1996 *USFWS Piping Plover Revised Recovery Plan*.

Limited areas of unoccupied suitable habitat may not be symbolically fenced to accommodate use of the ORV corridor; specifically in areas where the beach is wide enough to provide a 30-foot (9-meter) wide ORV travel/parking corridor above the berm crest. Selectively not symbolically fencing limited areas of suitable habitat in relation to the ORV corridor would be applied only in areas of the beach that are unoccupied suitable habitat; that is, no piping plovers are currently attempting to establish territories or nests. Apart from those limited exceptions, most of the suitable habitat for plovers along the ORV corridor would be symbolically fenced to protect breeding, feeding, and sheltering birds. An over-sand route is closed at any time that tides, nesting birds, or surface configuration prevent vehicle travel within the designated corridor (1998 Neg Regs). Therefore, placement of symbolic fencing to protect nesting shorebirds may temporarily close sections of the ORV corridor during the nesting season.

Shorebird management along ORV access along the corridor with nesting least terns is based on the 1998 Neg Regs, and the 2007 *Options for Managing ORV Access Plan* (NPS 2007b). As outlined in the 2007 plan, “measures to protect least terns in the ORV corridor would continue to follow the 1993 State Guidelines.” These documents provide detailed dates and criteria for installing symbolic fencing, minimum buffer distances for nests and unfledged chicks, and other aspects of managing recreation in proximity to terns. ORV use would not be allowed on any part of the corridor or other

areas unless ORV use can be managed consistent with these guidelines and in a manner that provides adequate protection for terns (NPS 2007b).

If possible, the national seashore would accommodate one or two SCV areas as described in the 1998 Neg Regs. Symbolic fencing would be adjusted to allow for an SCV area where there is no shorebird activity. In the spring (prior to Memorial Day weekend), the SCV area would not be larger than 0.1 mile (161 meters) long. Starting with the Friday before Memorial Day weekend, the two SCV areas combined would be no larger than 0.3 mile (483 meters) long. All possible efforts would be made to ensure that SCV areas are distributed between Race Point North and Race Point South to reduce effects on shorebirds on any one section of beach. If only one SCV area exists, the total length would not exceed 0.2 mile (322 meters). The SCV area would be approximately 75 feet (23 meters) deep at any time during the bird nesting/staging season.

Vehicles would be allowed access in the designated ORV corridor during the egg-laying and incubating phase of the nesting season provided that the beach is wide enough to adequately provide a protective buffer between the incubating adult plovers, terns, or American oystercatchers and the passing vehicles.

On sections of beach along the ORV corridor, piping plovers and least terns are occasionally within several feet (meters) of the high tide line. Field observations have shown that nesting birds often need less of a protective buffer from a moving vehicle passing in front of the symbolic fencing than a stopped vehicle or pedestrians. To provide vehicle access past these nests, “drive through only” corridors may be established if the incubating birds remain on the nest when the vehicle passes by and the vehicle corridor is in compliance with the 1998 Neg Regs. Shorebird staff would regularly monitor response of nesting plovers to disturbance since the amount of buffer needed by a particular nesting pair may change throughout the nesting season. Vehicles would be prohibited from stopping in these designated areas and must drive no faster than 5 miles per hour through these areas. If the section of beach with the nesting shorebird(s) is too narrow to drive on, or if the birds are disturbed by the passing vehicle, it would be closed to vehicular traffic.

As eggs hatch, sections of beach within the ORV corridor would be closed to protect the flightless chicks. These vehicle closures extend 0.2 mile (1,056 feet or 322 meters) on each side of the broods for piping plovers, 300 feet (91 meters) for least terns, and 656 feet (200 meters) for American oystercatchers; however, actual closure limits for each brood would be adjusted based on beach morphology, brood behavior, or other conditions as appropriate to ensure the chicks are protected, based on best professional judgment.

As of 2015, there are no records of American oystercatchers nesting in the North District, including the ORV corridor, but they are a common breeder in the South District. Every American oystercatcher nest would be protected using symbolic fencing, but the size of protective buffers may vary depending on location. Symbolic fencing and buffers would be placed around nests to reduce harm or minimize disturbance to incubating adults, eggs, and/or unfledged chicks.

Staging and migrating roseate terns, red knots, and other migrating shorebirds tend to be more tolerant of vehicles than they are of pedestrians or pets. In most cases, “drive/walk through areas” would be established in the ORV corridor along the upper beach, above staging/migratory shorebirds using the intertidal zone (appendix F). These areas would allow vehicle access through the area, but prevent vehicles from parking in front of resting birds. Pedestrians would be required to walk above the high tide berm. In recent years, approximately 1.5 miles (2.5 km) of beach has had these restrictions. Under this alternative, it is estimated that as much as 2.5 miles (4.0 km) of the ORV

corridor may be under such restrictions at any one time; however, this figure is only an estimate and would vary according to the actual pattern of use by the birds each year.

In addition, staging and migratory shorebirds sometimes congregate on sections of upper (dry) beach to rest, especially at high tide. To reduce disturbance, symbolic fencing/signs may be installed around consistently observed flocks or remain up on beaches after shorebird nesting is complete (appendix F). Areas along the corridor where resting or loafing of staging and migratory shorebirds is common includes, for example, Hatches Harbor, Race Point, and Exit 9 to High Head.

On stretches of beach where more than 100 roseate terns or red knots or other staging/migrating shorebirds are observed, sections of the beach may be temporarily closed if suitable buffers to reduce disturbance cannot be established. All efforts will be made to provide ORV access around the concentrations of shorebirds, when possible.

Pole Line Road (Power Line Route) would not be open if piping plovers or least terns are exhibiting territorial or nesting behavior in or adjacent to the route. If nesting activity occurs near Pole Line Road, a “drive-through only” area may be established past the nesting activities if the birds are not disturbed (e.g., remain on nest) when the vehicle passes. If American oystercatcher nests are established on or in proximity to Pole Line Road, an operational plan would be developed on a case-by-case basis.

If piping plover nests are established on or in proximity to the Inner Dune Route, an operational plan would be developed on a case-by-case basis.

Symbolic Fencing Outside the ORV Corridor

Symbolic fencing of suitable and historic shorebird nesting habitat outside the ORV corridor and life-guarded beaches occurs throughout the national seashore. These habitats would be considered for symbolic fencing in the future.

Some portions of suitable habitat on beaches outside the ORV corridor and life-guarded beaches that receive relatively little pedestrian visitation would not be initially symbolically fenced. On beaches that are not fenced, symbolic fencing and signs would be installed around all areas where piping plovers are observed exhibiting territorial and courtship behavior or where scrapes (a type of bird nest that is little more than a shallow depression in the sand) and nests are discovered.

Once nests are discovered, national seashore staff would adjust symbolic fencing to provide a 164-foot (50-meter) radius (buffer) to prevent disturbance around nests above the high tide line as recommended in the *1996 USFWS Piping Plover Revised Recovery Plan*. Fencing around nests would be evaluated and may be adjusted smaller or larger, depending on behavior of individual birds.

In cases where the nest is less than 164 feet (50 meters) above the high tide line, fencing would be placed at the high tide line and response of individual or more piping plover(s) to pedestrians would be monitored. Provided that the plover(s) are not exhibiting signs of disturbance, this smaller buffer may be maintained (USFWS 1994a). If the plover does show signs of disturbance or stress, a primary fenceline would be placed along the high tide line. This fenceline alone might not protect the nest from disturbance, but the fence would generally be safe from being washed away by the tide. An additional secondary fenceline (with no cotton twine) would be installed and extend into the intertidal zone, providing the adequate buffer distance from the nest to prevent disturbance. If the

second line of fence washes away at high tide and needs regular replacement, this section of beach may need to be temporarily closed to provide adequate piping plover protection.

Symbolic fencing and signs would be installed around all suitable least tern nesting habitat in high visitation areas. For beaches outside the ORV corridor that receive relatively little pedestrian visitation, symbolic fencing would be installed around all areas when least terns are observed exhibiting territorial and courtship behavior and/or where scrapes and nests are discovered. All least tern nests would be protected, including individual nests isolated from a larger colony. The 1993 MADFW Guidelines recommends providing a 50-yard (46-meter) radius buffer around least tern nests above the high tide line. Fencing around nests would be evaluated and may be adjusted, smaller or larger, depending on the behavior of individual birds (i.e., tolerance to disturbance).

In cases where the nest is less than 50 yards (46 meters) above the high tide line, fencing would be placed at the high tide line and a shorebird biological technician would monitor the response of the terns to pedestrians. Provided that the birds are not exhibiting signs of disturbance, this smaller buffer may be maintained in such cases. If terns show signs of disturbance, a primary fenceline would be placed along the high tide line. This fenceline alone might not protect the nest from disturbance, but the fence would generally be safe from being washed away by the tide. An additional secondary fenceline (with no cotton twine) would be installed and extend into the intertidal zone, providing the adequate buffer distance from the nest to prevent disturbance. If this second line of fence washes away at high tide and needs regular replacement, this section of beach may need to be temporarily closed to provide adequate least tern protection.

American oystercatchers would be evaluated on-site and management decisions would be made on a case-by-case basis. In most cases, American oystercatchers nest within established and protected piping plover and least tern nesting areas and would be managed with symbolic fencing and signs as described for least terns. A buffer would be placed around nests to reduce harm or minimize disturbance to incubating adults or unfledged chicks.

Symbolic fencing for staging and migrating shorebird would be installed for roseate terns, red knots, and other shorebirds along sections of beach throughout the national seashore. During staging and migration, these shorebirds tend to concentrate on upper (dry) sections of beach at high tide when sand flats are inundated by water. To reduce disturbance to shorebirds resting along the upper beach, symbolic fencing and “Area Closed – Bird Use Area” signs may be installed around flocks or remain up on beaches after shorebird nesting is complete to protect arriving staging and migrating shorebirds. Areas where this management strategy has occurred include:

- Coast Guard Beach in Eastham
- Jeremy Point
- Duck Harbor
- Hatches Harbor

In addition, at low-to-mid-tides, staging, and migrating shorebirds often rest in the intertidal zone. To reduce disturbance to these shorebirds, interpretive signs would be posted (without cotton twine) in the intertidal zone, thus guiding pedestrians along the upper beach, around the resting flocks. Areas where this management strategy has occurred include:

- Marconi Beach
- Jeremy Point

- Hatches Harbor
- High Head
- Race Point (North and South)

PARKING LOTS

Parking lots in proximity to piping plover nesting areas (e.g., Head of the Meadow) would be monitored frequently for piping plover activity and may close if there is shorebird activity in the lot. If it appears likely that unfledged piping plover chicks may access a parking lot from the beachfront, silt fencing or other similar material would be installed around sections of the perimeter of the parking lot and across pedestrian walkways. A set of stairs would be positioned over the silt fencing, at the main pedestrian path to provide pedestrian access to the beach. Depending on piping plover activity around the lot, certain pedestrian pathways may be temporarily closed at times throughout the season. If, after silt fencing, chicks are still observed in the parking lot, staff would be stationed in the lot each day until adults and chicks are no longer using the area, or the lot may be temporarily closed. In addition, to deter piping plover activity, parking lots would be kept clean of accumulated sand or standing water.

FLEXIBLE MANAGEMENT

Flexible management consists of reducing or eliminating protective measures in specific high-visitation areas to accommodate visitor use. Flexible management means not installing standard protection measures around piping plovers observed exhibiting courtship behavior and/or where there are active scrapes. Therefore, within sections of life-guarded beaches, symbolic fencing would not be installed as described in “Symbolic Fencing at Life-Guarded Beaches” above. If a nest is found within this area, it would be provided minimal protection. Symbolic fencing and signs would be erected to prevent the nest from being stepped on, but with less buffer distance than recommended in the *1996 USFWS Piping Plover Revised Recovery Plan*. Predator exclosures would not be installed around nests, even if exclosures were deployed elsewhere at the national seashore.

In May 2010, the US Fish and Wildlife Service issued a biological opinion and incidental take statement for the national seashore to flexibly manage up to three pairs of piping plovers nesting on or near high visitation beaches where the beach has eroded to the point where 164-foot (50-meter) buffers around plover nests would render the beach unusable to visitors at high tide. Under the no-action alternative, the biological opinion has been extended to cover management through the 2019 piping plover nesting season.

As outlined in the 2010 USFWS biological opinion, up to two sites in the national seashore would have these management options applied within a year. Flexible management may be implemented for no more than three pairs of piping plover, and extend along no more than 820 linear feet (250 meters) of beach at one site (measured from pedestrian access point), and a parkwide total of up to 1,312 feet (400 meters). A lateral buffer (parallel to the water) of 131 feet (40 meters) on each side of the nest would be installed, but the buffer would not extend far enough out toward the water to impede pedestrian access past the nesting area at high tide. If eggs within the nest hatch under these conditions, the lateral symbolic fencing would be maintained to provide a travel corridor for the chicks.

USE RESTRICTIONS

Fencing and buffers described above would be used to protect shorebird breeding, feeding, or sheltering habitat and activities and achieve the purpose and need as defined in this document (chapter 1). Therefore, sections of beach may be temporarily closed. Additional restrictions on various use would be necessary to meet management goals and objectives defined below.

Closures to protect staging/migrating shorebirds would generally occur from July 15 through October 15, although in all instances, closures may begin earlier or end later depending on the arrival or departure dates of shorebirds.

Pedestrians

Where beaches are narrow, it is not always possible to provide a sufficient buffer to prevent disturbance to the piping plover, least tern, and American oystercatcher nests from visitors. Therefore, sections of beach may be temporarily closed at times if adequate buffers cannot be established at high tide during the incubation phase of nesting. Pedestrians would be able to access the area at low tide when there is adequate exposed beach. Additionally, sections of beach may be temporarily closed if visitors are observed several times during a week inside the unstrung secondary fence line or if there are concerns that day hikers who start at low tide may not be off the beach in time to safely pass the nesting area without disturbing the nesting piping plovers, least terns, or American oystercatchers. These sections of beach may remain closed for an additional one to three days after hatching to protect newly hatched chicks. Where possible, detours would be established to allow visitor access around any closed sections of beach.

Examples of areas at the national seashore that have been closed to pedestrian access to protect piping plovers, least terns, and American oystercatchers include:

- Coast Guard Beach in Eastham
- Duck Harbor
- Great Island
- Head of the Meadow
- Jeremy Point
- Race Point

Pedestrian walkways, or access past areas of piping plover breeding, feeding, or sheltering, may also be temporarily closed or re-routed if incubating piping plovers are observed leaving or getting off their nests when pedestrians walk by. These sections of beach may remain closed for an additional one to three days after hatching to protect the newly hatched chicks. The placement and design of informational/directional signs would be evaluated on a case-by-case basis. On beaches with high visitation, national seashore staff and volunteers may be stationed at closures to explain the closure and provide information on alternative routes.

For staging and migrating shorebirds, the national seashore would limit disturbance to roseate terns, red knots, and other shorebirds by limiting some activities and directing pedestrians and pets around areas where the birds congregate. If more than 100 staging/migrating shorebirds are regularly observed, protective measures may be implemented. Sections of beach with historic concentrations

of migratory and staging shorebirds and with pedestrian access to tidal flats and distal tips could continue to be restricted from July 15 through October 15.

Interpretive signs would continue to be installed on the marsh side of Hatches Harbor Spit to discourage beachgoers from approaching too close to staging shorebirds. In addition, signs would continue to be affixed to buoys mid-channel on the marsh side of the spit specifically to deter beachgoers from crossing the channel and disturbing flocks of staging shorebirds on the exposed mudflats. Signs may continue to be installed in the intertidal zone and upper beach to prevent pedestrian disturbance of shorebirds as has occurred at the southern tip of Coast Guard Beach in Eastham and sections of Jeremy Point (appendix F).

Motorized and Nonmotorized Boat Landing

To prevent disturbance to nesting shorebirds from boat traffic, the national seashore would temporarily close to boat landing on narrow section of the southern tip of Jeremy Point that support nesting piping plovers, least terns, and American oystercatchers if the buffer to prevent disturbance, especially at high tide cannot be attained. Large informational signs (or buoys) would be placed in the water or on the shoreline in front of the closed area to inform approaching boaters of this closure. Sections of shoreline on either side of this closure would remain open to boat landing, if possible.

Other sections of narrow beach (e.g., Coast Guard Spit in Eastham) with nesting piping plovers would be temporarily closed to boat landings. If least terns and American oystercatchers are present, the sections of narrow beaches would be evaluated on a case-by-case basis for temporary closure to boat landing if an adequate buffer to prevent disturbance cannot be made between the visitors and nesting shorebirds.

Interpretive signs would be installed on the marsh side of Hatches Harbor Spit to discourage boaters from approaching staging/migrating birds. Interpretive signs would also be placed throughout the marsh at Hatches Harbor (appendix F).

Sections of intertidal zone with greater than 100 staging/migrating shorebirds may be temporarily closed to boat landing. An example of intertidal zone shorebird habitat subject to closures occurs on the southern tip of Jeremy Point. Large informational signs would be installed in the water in front of the closed area to inform approaching boaters of this closure. Sections of shoreline on either side of this closure would be open to boat landing.

Pets

Pets are required to be on a leash at all times in the national seashore (36 CFR 2.15). Coast Guard Beach (south of pedestrian access) / Nauset Marsh, Eastham, and Jeremy Point would be closed to pets from April 1 through September 30. The marsh area of Hatches Harbor would be closed to pets when there are more than 100 staging and migrating shorebirds; it would remain closed until September 30th. Signs would be posted along the high tide line on the marsh-side of Hatches Harbor Spit. The ocean-side of the spit would remain open to leashed pets.

Additional sections of bay and ocean beaches may be temporarily closed to pets as needed to protect staging and migratory shorebirds if more than 100 shorebirds are regularly observed using the beach

habitat. Beaches that do not have nesting shorebirds or concentrations of staging and migrating shorebirds would remain open to leashed pets.

Pet closures would also occur for piping plovers, least terns, and American oystercatchers on bay and ocean beaches where nests and unfledged chicks are present. During the egg phase, pet closure would be posted approximately 200 feet (61 meters) from any nest or at the ends of any fencing that supports multiple nests. Signs would extend from the symbolic fencing down into the intertidal zone. The only exception to this scenario would be along the ORV corridor where a dog inside a vehicle can pass pet closures to access areas of beach open to pets. As eggs hatch and unfledged chicks are present, pet closures would be implemented until the chicks fledge. The extent of the closures would be based on a determination of the area used by the chicks with a 164–246 foot (50–75 meter) buffer applied to each side of that brood's area of use (piping plovers and American oystercatchers) or colony (least terns).

Beaches that do not have nesting shorebirds or concentrations of staging and migrating shorebirds would remain open to leashed pets.

Aerial Recreation Activities

All aerial activities including, for example, hand-held kites, remote or radio-controlled planes, and para/hang gliding would be prohibited above and within 656 feet (200 meters) of posted shorebird use areas and on life-guarded beaches.

Kiteboarding (also known as kitesurfing) is prohibited from March 15 through October 15 on all open waters on ocean and bayside (2014 *Cape Cod National Seashore Compendium*). One exception to this closure is a small section of beach owned by the town of Wellfleet at Duck Harbor (if more than 650 feet [200 meters] away from posted shorebird use areas) where kite surfers can launch their kites and take a direct route, 0.25 mile (400 meters) offshore, outside of the national seashore boundaries.

MANAGEMENT OF PREDATOR IMPACTS

For the protection of piping plover nests, under the no-action alternative, national seashore staff would evaluate and use (when and where deemed appropriate) nonlethal predator management through education, garbage management, and installation of predator exclosures around piping plover nests and tern shelters.

Education and Enforcement of Prohibition on Feeding National Seashore Wildlife

National Seashore staff would provide interpretation, education, and outreach efforts with visitors to communicate that feeding wildlife by the public is illegal in all national park units (36 CFR 2.2(a)(2)).

Garbage Management

Garbage or trash left by visitors attracts predators such as American crow, Eastern coyote, gulls, raccoons, skunks, feral cats, and red fox. The National Park Service has a carry-in/carry-out policy at

the national seashore to avoid having trash cans as concentrated food sources for wildlife to take advantage of on beaches. The national seashore staff would continue interpretive and educational efforts to inform visitors of the importance of the carry-in/carry-out trash policy.

Predator Exclosures

Two predator exclosure designs are commonly used at the national seashore:

1. Circular Exclosure – This design has been used at the national seashore since the early 1990s (figure 2). The circular exclosure is 10 feet (3 meters) in diameter, 3 feet (1 meter) high, and constructed of wire fencing. Plastic mesh bird netting is secured to the top.
2. Canopy Exclosure – This design uses fencing to create a 4 x 4 foot (1.2 x 1.2 meter) square exclosure, 3 feet (1 meter) high (figure 3). Heavy gauge plastic netting is secured over the top and extends from all sides creating a canopy secured with posts. Additional fencing is attached to two of the sides creating a second, domed top.

Also, if predator exclosures are deployed, some incomplete clutches (nests where egg-laying is in process) would be exclosed to reduce the chance of predation on eggs. Nests would not be exclosed when they are: (1) located in thick vegetation, (2) located on the side of a dune or cliff that precluded installing an exclosure due to slope or nest location, or (3) when a group of exclosed nests have been abandoned on a single day at a particular site and there are concerns regarding adult piping plover mortality associated with exclosure use. Exclosures may also be removed if tracking or direct observations indicated that predators are keying-in-to (repetitively visiting and/or searching for) exclosures and harassing incubating adults.



FIGURE 2. CIRCULAR PREDATOR EXCLOSURE DESIGN USED AT CAPE COD NATIONAL SEASHORE



FIGURE 3. CANOPY PREDATOR EXCLOSURE DESIGN USED AT CAPE COD NATIONAL SEASHORE

The use of exclosures would be evaluated annually and/or on a case-by-case basis. If an exclosure is used, the nest would be monitored after installation until an adult returns to the nest, resumes incubation, and then exchanges places with its mate. If neither adult returns to the nest within 60 minutes, or the bird's behavior appears abnormal (i.e., showing signs of stress including running in and out of the base of the exclosure), the exclosure would be removed. To reduce the chance of predation on eggs, some incomplete clutches may be exclosed before the pair is actively incubating eggs. If the incomplete nest is then abandoned, a re-nest attempt may not be exclosed until complete and the pair is actively incubating eggs to evaluate if the pair accepts the exclosure around the nest. Exclosures may also be removed at any time during incubation if there is concern for the safety of the adult birds. Examples of when removal could occur include: (1) if there is an adult mortality or vandalism at the exclosure or at a nearby exclosure, or (2) if predators are keying into the exclosure.

Tern Shelters

In an effort to increase least tern chick survival, triangular plywood tern shelters (25 in x 8 in x 8 in [approximately 55 centimeters [cm] x 20 cm x 20 cm]) may be placed inside colonies to provide shade and shelter to the chicks (Kress and Hall 2004).

ALTERNATIVE B: INCREASED PROTECTION AND FLEXIBLE MANAGEMENT PLUS ADDITIONAL MANAGEMENT OF PREDATOR IMPACTS (NPS PREFERRED ALTERNATIVE)

Under alternative B, the national seashore would manage shorebirds to improve productivity to meet recovery goals through a combination of increased shorebird protection by implementing additional geographic or temporal restrictions balanced with flexible management at specific high visitation areas to maintain visitor access, plus decrease predator impacts by implementing additional nonlethal and selective lethal management practices to reduce loss of nests and chicks.

Management in alternative B would be the same as described under the no-action alternative with the following changes listed below.

SYMBOLIC FENCING AND BUFFERS

Same as no-action alternative.

Symbolic Fencing of Life-Guarded Beaches

Portions or all of the six life-guarded beaches would not be symbolically fenced (four beaches are excluded in the no-action alternative) regardless of suitable habitat or historic use by any shorebird species, and would be considered for flexible management if necessary. The total length of all life-guarded beaches that would not initially be symbolically fenced would be 7,052 feet (1.3 miles), as compared to the no-action alternative which would not symbolically fence 0.75 miles of life-guarded beach. In addition, main pedestrian access paths to the life-guarded beaches will remain open, regardless of shorebird activity. This would allow for consistent recreational and pedestrian use of these beaches. Shorebird staff would closely monitor these unfenced sections of beach and symbolically fence them if a concentration of piping plover tracks or territorial or courtship behavior is observed; in lieu of symbolically fencing these sections, park management could designate them for flexible management (see below).

The beaches and nominal approximate lengths that would not be symbolically fenced are as follows:

- Coast Guard (Eastham): 1,634 feet (498 meters) of life-guarded beach.
- Nauset Light: 1,319 feet (402 meters) of life-guarded beach.
- Marconi Beach: 1,319 feet (402 meters) of life-guarded beach.
- Head of the Meadow: 285 feet (87 meters) of the life-guarded beach (south side). If in the future the area of use by nesting shorebirds shifts laterally, north or south, away from the life-guarded beach area, additional lengths of Head of the Meadow life-guarded beach may remain unfenced.
- Herring Cove: 1,204 feet (367 meters) of life-guarded beach.
- Race Point: 1,204 feet (367 meters) of the life-guarded lower beach would not be symbolically fenced to provide shorebird protection. If in the future the Race Point life-guarded beach seasonally narrows, similar to the configuration of Marconi or Nauset Light

beaches, this entire life-guarded beach may remain unfenced to provide continued public access.

Symbolic Fencing in ORV Corridor

Limited areas of unoccupied suitable habitat may remain unfenced to accommodate use of the ORV corridor. Suitable plover habitat would be symbolically fenced except in areas where the beach is wide enough to protect most suitable habitat for breeding, feeding, or sheltering; in these areas, 45 feet (14 meters) would remain unfenced (an increase from 30 feet [9 meters] under no action) between the berm crest and the fencing to accommodate driving lanes. Areas to be considered for removing and reducing the amount of fencing must be at least 0.1 mile from any shorebird nest to reduce threats to birds foraging.

To provide vehicle access past nests, “drive through only” corridors may be established with the following restrictions: (1) the nest or territorial /courting behavior (including nests prior to egg laying) is at least 82 feet (25 meters) from the drive-through corridor, (2) the birds are tolerant of this reduced buffer, (3) the beach topography allows adequate visibility for vehicles to see birds that are in or are approaching/crossing the driving lane. Where the beach is too narrow, the 45 feet (14 meter) driving lane would be reduced accordingly or could be closed until the beach is wide enough to protect most suitable habitat and allow safe vehicle access.

Every least tern nest would be protected using symbolic fencing. The national seashore staff would follow the 1993 MADFW Guidelines where possible, but the size of protective buffers may vary depending on the management scenario.

Shorebird management action for American oystercatchers would be the same as the no-action alternative.

Symbolic Fencing on All Other Beaches

Same as the no-action alternative.

Parking Lots

Under alternative B, parking lots would not be closed except to herd shorebirds from parking lots, as described in “Parking Lots” under “Flexible Management” section below.

FLEXIBLE MANAGEMENT

Under alternative B, flexible management would be expanded to include all life-guarded beaches the parking lots associated with the life-guarded beaches, Pole Line Road and Inner Dune Route. Flexible management would increase to no more than five pairs of piping plovers total in a season, regardless of the total length of beach, number of sites, access route locations, etc., whereas under the no-action alternative, up to three pairs of piping plovers could be flexibly managed.

Life-Guarded Beaches

If flexible management is implemented at life-guarded beaches the lateral buffer would be reduced to 33 feet (10 meters) on each side of the nest. Under the no-action alternative, this buffer is larger at 131 feet (40 meters).

Parking Lots

Parking lots at the national seashore would remain open regardless of shorebird activity except for a temporary closure to “herd” flightless chicks to the beach. If a flightless chick or brood is observed in a parking lot, the lot would be temporarily closed to vehicle activity until the chick or brood is herded back to the beach by shorebird staff and silt fencing is in place. If adult birds are observed in the parking lot, shorebird staff would approach the bird(s) causing them to fly away. Since it is likely that birds may return to a parking lot, shorebird staff would closely monitor the parking lot for any bird activity (adult or chicks) throughout the rest of the nesting season.

Pole Line Road and Inner Dune Route

Pole Line Road and Inner Dune Route would be managed in accordance with the 1998 Neg Regs. Sections of the Pole Line Road and Inner Dune Routes would not initially be symbolically fenced in the spring and would remain open (available) as travel routes. However, if piping plover nests are established on or close to the Pole Line Road and it is apparent through observation that the plover adult is likely to abandon a nesting attempt or would stop incubating eggs as vehicles passed, the road would be closed to vehicles and symbolic fencing would be erected. Also in this scenario, these access roads could be considered for flexible management at the discretion of park management, as long as the flexible management threshold (five pairs) has not been exceeded. If piping plovers nest off Pole Line Road, including in the cobble field, the road would remain open as a 5 miles per hour (mph) drive-through section with no pedestrian access until hatching. If or after eggs hatch, the road would be closed except for national seashore essential vehicles and vehicle escorts to the lighthouse in accordance with the USCG/ALF 2007 *Race Point Lighthouse Essential Vehicle Management Plan* (appendix D).

USE RESTRICTIONS

Pedestrians

Pedestrian restrictions for nesting shorebirds (piping plovers, least terns, and American oystercatchers) would be the same as the no-action alternative for closures, buffers, and signs.

For migrating shorebirds, area closures would be established to protect historically important staging and feeding areas from human disturbance and reduce displacement of the birds from the habitat caused by recreational beach use. Closures may occur on resting or feeding areas that have been important for roseate terns and red knots in more than one of the past five years for example: sections of Hatches Harbor/Herring Cove, the southern tip of Coast Guard Beach in Eastham, Nauset Marsh, and sections of Jeremy Point (appendix F).

At Hatches Harbor Spit and the northern tip of Herring Cove, “Area Closed” signs would be affixed to buoys prohibiting beachgoers from crossing the channel and disturbing flocks of staging

shorebirds on exposed tidal flats. In addition, “Area Closed” signs would be installed throughout the marsh prohibiting pedestrian access (appendix F).

In other areas throughout the national seashore that are not historically important staging areas and where more than 100 roseate terns, red knots, or mixed flocks of shorebirds have congregated, upper or lower beach protective measures would be implemented. An example of this is if shorebirds are observed in an area in the morning but leave the area when visitors arrive; however, the shorebirds are observed in this same area again the following morning indicating that this area is important for staging during this season. To reduce disturbance to birds resting along the upper beach, symbolic fencing with string and “Area Closed – Bird Use Area” signs would be installed around these flocks (appendix F). If these birds are using the intertidal zone at low- to mid-tides, pedestrians would be rerouted along the upper beach, around the resting flocks (appendix F). In all cases, efforts would be made to provide pedestrian access.

Motorized and Nonmotorized Boat Landing

Coast Guard spit in Eastham is highly used by shorebirds for both nesting and staging; however, a portion of the tip of Coast Guard spit in Eastham would remain open for boat landing; the only exception would be times that this portion had to be closed to protect nesting piping plover, as described in the no-action alternative. If, in the future, new information indicates a boat closure would be warranted, the national season may implement additional boat landing restrictions here.

Boat closures would be established on some beaches for roseate terns, red knots, and other migrating shorebirds as the birds begin to arrive. This closure would protect historically important staging and feeding areas from boat disturbance and reduce displacement of the birds from the habitat. Closures would be located on resting or feeding areas that have been important for roseate and common terns and red knots in more than one of the past five years.

In addition to the closures described under the no-action alternative, other sections of bay and ocean beaches may be temporarily closed to boats from July 15 through October 15 to protect staging/migrating shorebirds if more than 100 roseate terns, red knots, or mixed flocks of shorebirds are regularly observed using the beach habitat.

To reduce disturbance from kayaks and other boats to staging, migrating, and feeding shorebirds, some channels in Nauset Marsh, where there are concentrations of shorebirds, may be temporarily closed from July 15 through October 15. Other channels in Nauset Marsh would remain open throughout this time period.

Additional intertidal areas with concentrations of staging and migrating shorebirds would be temporarily closed to boat landings. Signs would be placed in the water in front of the closed areas to inform approaching boaters of such closures. Areas on either side of the closure would be open for boat landing. It is anticipated that closures of this type would be necessary at Jeremy Point in all or most years.

Tidal flats along the east side of Hatches Harbor would be closed to boat landing. Signs would designate closed areas in the mid-channel between the spit and the marsh. Signs would be installed along the perimeter of these flats where needed, including along the northeast corner of Herring Cove (appendix F).

Pets

Areas would be closed to pets, as described below, when needed to protect shorebirds during nesting (generally April through August) and staging period (generally July 15 through October 15). An exception would be along the ORV corridor where a dog inside a vehicle can pass pet closures to access areas of beach open to pets.

Pet closures would be extended to October 15 for Coast Guard Beach (south of pedestrian access), Nauset Marsh in Eastham, Jeremy Point, Hatches Harbor (including the marsh and spit), and the northern tip of Herring Cove.

For nesting shorebirds, pet closures would be posted approximately 200 feet (61 meters) from symbolically fenced areas where breeding, feeding, or sheltering are regularly observed. These sections of beach would re-open to pets when the post-breeding adults and fledged chicks are not seen for five consecutive days.

Aerial Recreation Activities

Paragliding and hang gliding would be prohibited from March 15 to October 15.

MANAGEMENT OF PREDATOR IMPACTS

Alternative B incorporates an integrated predator management program using methods approved by the national seashore and US Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS), Wildlife Services Directives 2.430 and 2.505) and American Veterinary Medical Association (AVMA 2007). The integrated predator management program would use both nonlethal and lethal techniques for selective management of mammalian (USDA 2004, 2005, 2011a) and avian (USDA 2003, 2010a, 2010b) predators (2011a). Depending on the circumstances at any given time, use of a particular method may have advantages and disadvantages. Therefore, these methods would be used in various combinations and degrees of intensity depending on local conditions and history or other circumstances.

Predator management, particularly the use of lethal controls, is not intended to eradicate national seashore-wide populations of any predator species; rather, predator management would target individuals or small groups of predators that are selectively preying on adults, chicks/young, and eggs of nesting shorebirds as well as inducing abandonment of nests. Selective predator management on specific beaches at the national seashore would be analyzed on a yearly basis. The US Fish and Wildlife Service would be consulted prior to selective predator removal actions to determine if the proposed project is compatible with the *1996 USFWS Piping Plover Revised Recovery Plan*.

The dominant native predators of beach nesting birds at present are the American crow and Eastern coyote, but other native species such as gulls, raccoons, or skunks or nonnative species such as the red fox and feral cat remain a concern. Regardless of species, selective predator management would be directed toward individuals at a particular nesting site, not at the larger population, and timed to achieve effects during the nesting season. The proposed predator management program would be adaptive in nature, allowing the national seashore staff to use the predator control methods most appropriate for the predator species (mammalian or avian). After identification of target predators, the most effective, selective, and humane tools available would be used to deter or remove individuals of the particular predator that is threatening nesting success. For example, denning, a

technique that targets species or entire subgroups and not individuals, will not be approved for use in the national seashore. The following nonlethal or lethal predator management tools would be available, as described.

Nonlethal Tools

Nonlethal tools would include those described under the no-action alternative plus the following:

Garbage Management. In addition to existing carry-in/carry-out policy, the national seashore staff would evaluate a variety of options to enhance trash management including installing predator-proof receptacles, improved pick-up where needed (especially on life-guarded beaches near nesting areas), and increased interpretive and educational efforts to inform visitors of the importance of the carry-in/carry-out trash policy. The national seashore staff would educate residents of the surrounding communities to this problem and encourage appropriate garbage management to reduce the availability of garbage to opportunistic wildlife species.

Electric Fencing. Nonlethal electric fencing may be installed around nesting areas to prevent/reduce mammalian predation on nests/chicks. Electric fencing has been used effectively at many sites to increase productivity for nesting shorebirds and would be evaluated for use at the national seashore.

Lethal Tools

Selective Predator Removal Criteria. Selective predator removal could take place anywhere in the national seashore. The specific locations and timing of predator removals will likely vary year to year according to the results of monitoring data collected in the previous years and during the current nesting season. The specific predator species, number of individuals removed, and locations of removal would be evaluated according to the following criteria:

- Predator removal would be focused on sections of beach with historically high shorebird activities that are experiencing low productivity and high depredation as determined by monitoring during the previous season(s).
- Predator removal would be focused on beaches where predation is responsible for more than 50% of shorebird nest loss, as determined by monitoring results from the previous year and during the current nesting season.
- Selective predator removal would be implemented when monitoring activity shows that:
 - piping plover productivity is below the 1996 USFWS Revised *Piping Plover Recovery Plan* productivity goal of 1.5 chicks fledged/pair and when predation is determined to be responsible for this low productivity
 - least tern productivity is less than or equal to 0.75 fledgling/pair and predation is determined to be responsible for this low productive
- In the first two years of implementation, the number of predators removed each year would be capped at 50 animals (total of all predator species combined). After two years, this number would be evaluated based on the monitoring data and the number of animals removed may be adjusted up or down as needed to remove the fewest number of predators necessary to effectively achieve shorebird productivity targets.

Beaches with nesting American oystercatchers might not be specifically selected for predator removal, but their presence would be considered in the decision-making process.

The need for predator management on specific beaches would be evaluated on a yearly basis. In a typical year, the entire seashore could be reviewed to determine selective predator management priorities for that year but it is anticipated that selective predator management would take place on only a small fraction of national seashore beaches in any given year.

Removal Methods

The national seashore staff would work in coordination with the USDA, APHIS Wildlife Services to choose the appropriate lethal management method or methods for the targeted predator species. APHIS Wildlife Services would also work closely with national seashore staff to ensure appropriate public safety and enforcement. Efforts would be made to use lethally removed animals for research and educational purposes which would result in additional knowledge being gained relative to local predator biology.

It is expected that one or more of the following methods would be used when the lethal management method is determined to be necessary:

Shooting. Shooting is an effective method to remove an individual or small number of predators. It can provide immediate relief from a predator impact and is, therefore, often the most efficient method. The appropriate firearm will be used by APHIS Wildlife Services to lethally remove the predators. All firearm safety precautions would be followed by APHIS Wildlife Services when conducting activities using firearms and would comply strictly with all laws governing the use of firearms.

Nocturnal predators, such as coyotes, foxes, skunks, etc., may be illuminated at night with spotlights or located with thermal imaging equipment.

Trapping. Authorized personnel from APHIS Wildlife Services conducting trapping would make recommendations to the national seashore using their best professional judgment about the trap type, array alignment, and specific quantities of traps to be deployed. Full-body live traps or immediate-lethal traps would be the only removal methods considered. Foot-hold traps would not be used. Traps would be placed in the immediate vicinity of noted predation events and would be spaced 164–328 feet (50–100 meters) apart. The spacing of the traps would be dependent on the amount of available habitat and mammalian predator activity. APHIS Wildlife Services biologists would set traps at dusk and check them the following morning each day. Traps would be checked daily at first light.

Trap locations would be chosen dependent on the following primary factors:

- Locations with historically high density of nesting shorebirds that have been heavily predated.
- Capturing a targeted mammal would reduce potential predation on the protected species.
- Visitor use in the vicinity.
- Suitability for trap deployment. Areas with restricted access points (islands and peninsulas) are desirable.

- Trapping areas would be identified through signs and/or fencing and closed to people and pets. Increased patrol efforts by law enforcement would occur.

Avicide. Crows that are selectively preying on shorebird nests (eggs and chicks) could be removed with DRC-1339 (3-chloro-4-methylbenenamine hydrochloride), a slow-acting avian toxicant that is rapidly metabolized and/or excreted. DRC-1339 is registered with the Environmental Protection Agency (EPA) (EPA Reg. No. 56228-29) to control ravens, crows, and blackbirds. Birds ingesting a lethal dose of DRC-1339 usually die in 12–72 hours. Because of the rapid metabolism of DRC-1339 in the body, it poses little risk of secondary poisoning to nontarget animals (Cunningham et al. 1979; Schafer 1981; Knittle et al. 1990). DRC-1339 is unstable in the environment and degrades rapidly when exposed to sunlight, heat, or ultra-violet radiation. DRC-1339 is highly soluble in water but does not hydrolyze and degradation occurs rapidly in water (USDA 1997). This compound is also unique because of its relatively high toxicity to some species (e.g., crows), but low-to-moderate toxicity to most predatory birds and almost no toxicity to mammals (DeCino et al. 1966; Schafer 1981).

At the national seashore, crows foraging within shorebird nesting areas could be targeted for removal, following APHIS Wildlife Services protocol. Removal would begin in late winter–early spring and extend into late spring.

ALTERNATIVE C: CURRENT MANAGEMENT ACTIONS PLUS ADDITIONAL MANAGEMENT OF PREDATOR IMPACTS

Under alternative C, the national seashore would manage shorebirds to improve productivity to meet recovery goals entirely through management of predator impacts to reduce the losses of nests and chicks to predation. There would be no changes in the use and access restrictions that are currently in place. Thus, under alternative C, the national seashore would manage shorebirds as described in the no-action alternative but with the addition of predator management options, including lethal removal of predators, as described under alternative B.

SYMBOLIC FENCING AND BUFFERS

Symbolic Fencing on Life-Guarded Beaches

Same as no-action alternative.

SYMBOLIC FENCING IN THE ORV CORRIDOR

Same as no-action alternative.

SYMBOLIC FENCING OF ALL OTHER BEACHES

Same as no-action alternative.

FLEXIBLE MANAGEMENT

Same as no-action alternative.

USE RESTRICTION

Pedestrians

Same as no-action alternative.

MOTORIZED AND NONMOTORIZED BOAT LANDING

Same as no-action alternative.

PETS

Same as no-action alternative.

AERIAL RECREATION ACTIVITIES

Same as alternative A, plus a total ban on kite boarding throughout the national seashore.

MANAGEMENT OF PREDATOR IMPACTS

Predator management would be conducted as described in alternative B.

ALTERNATIVE D: MAXIMUM SHOREBIRD HABITAT PROTECTION

Under alternative D, the national seashore would manage shorebirds to improve productivity to meet recovery goals entirely through protective measures that prevent disturbance of birds by visitor activities. During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches and their associated parking lots. Alternative D includes nonlethal methods to manage predator impacts but does not include any lethal methods of managing predator impacts.

SYMBOLIC FENCING AND BUFFERS

Same as alternative B.

Symbolic Fencing of Life-Guarded Beaches

Same as alternative B.

Symbolic Fencing in ORV Corridor

Entire sections of beach (i.e., from bluff toe to waterline) and access points would be closed where shorebird breeding, feeding, or sheltering activities are observed.

Symbolic Fencing at All Other Beaches

Symbolic fencing would be placed along all suitable and historic shorebird breeding, feeding, or sheltering habitat and access points from March 15 through October 15. This would include much of the ocean and bayside beach managed by the national seashore. The amount of fencing will vary from year to year, but approximately 27 miles (44 kilometers [km]) of beach from the bluff toe to the waterline in the national seashore would be closed to visitor access under alternative D, versus a similar 27 miles where typically only the upper beach would be closed under alternatives A, B, and C.

FLEXIBLE MANAGEMENT

Same as alternative B.

Life-Guarded Beaches

Same as alternative B.

Parking Lots

Same as alternative B.

Pole Line Road and Inner Dune Route

The Pole Line Road and Inner Dune Route would be managed in accordance with the 1998 Neg Regs. Unless sections of outer beach immediately accessible by these access routes are open to ORV use (i.e., not closed for shorebird protection as described in this alternative), the Pole Line Road and Inner Dune Route would be closed for general and commercial ORV use but available for access to dune shacks and the race point lighthouse per USCG/ALF 2007 *Race Point Lighthouse Essential Vehicle Management Plan* (appendix D). If piping plover nests are established on or in proximity to the Inner Dune Route, an operational plan would be developed on a case-by-case basis.

USE RESTRICTIONS

Pedestrian

From March 15 to October 15, all historic shorebird-use-areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, including pedestrian access, except at the six identified national seashore life-guarded beaches.

Motorized and Nonmotorized Boat Landing

From March 15 to October 15, all historic shorebird-use-areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, including motorized and nonmotorized boat landing.

Pets

From March 15 to October 15, all historic shorebird-use-areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, including pet access.

Beaches not identified as shorebird use areas would be open to leashed pets. Regulations would require that pets be on a leash at all times in the national seashore (36 CFR 2.15). Dogs used for hunting would be managed under current regulations (36 CFR 1.5 Section 2.15 [b]).

Aerial Recreation Activities

From March 15 to October 15, all historic shorebird-use-areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, including aerial recreation activities.

In addition, restrictions for seasonal closures or the distance from shorebird-use areas for kite flying and other airborne device, remote or radio control planes, kitesurfing, and para/hang gliding under alternative B would remain in effect.

MANAGEMENT OF PREDATOR IMPACTS

Predator management would be conducted using the nonlethal tools described in alternatives A and B. Alternative D does not include lethal predator management.

ALTERNATIVES OR ACTIONS CONSIDERED BUT DISMISSED

Table 1 summarizes the actions initially considered as potential solutions for updating management of ocean beach and bayside special status species of the national seashore, but were later dismissed from further analysis.

TABLE 1. ALTERNATIVES CONSIDERED BUT DISMISSED FROM FURTHER REVIEW

Alternative	Reason for Dismissal
No ORVs allowed during nesting season or phase out ORVs.	Inconsistent with the national seashore establishing legislation or ORV Negotiated Rule Making (36 CFR 7.67).
Open the entire beach from P-Town to Chatham to ORVs (spread out impacts).	This action does not meet NPS mission, ORV Negotiated Rule Making (36 CFR 7.67), nor the purpose and needs to protect shorebirds.
Close portions of the beach to all people all year-round to protect birds.	The shore bird nesting season is generally March through August, and the staging period is generally from mid-July through mid-October. Closing the beaches year-round would not provide additional benefit for the shorebirds.
Create “shorebird advisory board.”	Federal Advisory Committee Act board already exists within seashore to advise the superintendent.
Establish “no bird areas” and “bird areas” and move any birds/eggs from no bird to bird areas.	This action is determined to be infeasible. This action would require additional funding and staff to move nests and regulate areas, which is not available. Further, this action would also create enormous stressors on the birds that would lead to nesting failures, causing “take” under the Endangered Species Act” and reduce productivity. Does not meet NPS mission and purpose and needs to protect shorebirds.
Keep whole ORV corridor open to driving with escorts or “self-escorts.” Establish on and off hours (1 hour in a.m. and 1 in p.m.)	Inconsistent with the ORV Negotiated Rule Making (36 CFR 7.67), NPS conservation mandate and resource management policies, and other laws related to the protection of endangered species including habitat for breeding, feeding, and sheltering.

Chapter 3: Affected Environment and Environmental Consequences

INTRODUCTION

This chapter describes the methodology for analyzing impacts, the affected environment of each impact topic retained for detailed analysis, and an analysis of the impacts that could result from implementing any of the alternatives. This chapter is organized by impact topic to allow a comparison among alternatives based on issues. The impact topics are presented in the order they appear in chapter 1.

GENERAL METHODS FOR ANALYZING IMPACTS

In accordance with Council on Environmental Quality regulations, direct, indirect, and cumulative impacts are described (40 CFR 1502.16) and the intensity of the impacts is discussed in the context of the park and region. (40 CFR 1508.27). Where appropriate, mitigating measures for adverse impacts are also described and incorporated into the evaluation of impacts. The specific methods used to assess impacts for each resource may vary; therefore, these methodologies are described under each impact topic.

The National Park Service based these impact analyses and conclusions on a review of existing literature, studies, and research performed by the national seashore, information provided by experts within the national seashore, and other agencies and institutions, professional judgment, staff expertise and insights, and public input.

Type of Impacts. Impacts are discussed by type, as follows:

Direct Impacts	Impacts that would occur as a direct result of NPS management actions.
Indirect Impacts	Impacts that would occur as a result of NPS management actions but would occur later in time or farther in distance from the action.
Cumulative Impacts	Defined as “the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions” (40 CFR 1508.7).
Beneficial Impact	A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
Adverse Impact	A change that degrades the resource or moves the resource away from a desired condition, or detracts from its appearance or condition.

Scenario for Cumulative Impact Analysis. Past, present, and reasonably foreseeable actions that contribute to cumulative impacts on the resources that would be affected by the shorebird management plan were identified during internal and external scoping. These include actions taken

by others in the surrounding area and/or actions taken at the national seashore that are unrelated to the shorebird management plan; but in all cases, these other actions may have impacts on the same resources or values as the alternatives evaluated for shorebird management, resulting in an additive (cumulative) effect. Once these other actions were identified, cumulative impacts were determined by generally assessing the impacts of those other actions then combining those impacts with the impacts of the shorebird management alternatives to estimate the overall cumulative impacts. Some projects that were identified are in the early planning stages or too far into the future, and impacts could not be determined. Other projects or actions that may affect the same resources as the proposed shorebird management alternatives include:

Cape Cod Master Plan – Water Quality/Restoration – Clean Water Act Section 208: This is a Cape-wide water quality plan to protect human health and wildlife habitat provided within the *Cape Cod Master Plan*. The plan has been completed and is in the process of being implemented. Implementation of a Cape-wide plan to comply with Clean Water Act Section 208 would positively impact shorebirds by reducing nutrient inputs, leading to improved water quality and reducing hypoxia/anoxia, and blooms of macroalgal and toxic algal. These changes would in turn lead to increased invertebrate diversity and abundance. These improvements will lead to a more complex and resilient food web for breeding and feeding resident and migrating shorebirds, and reduce the potential for impacts from toxic algal blooms. Increased food availability would positively affect energy conservation (increased fitness for breeding, staging and migrating), including enhancing food availability for young shorebirds thus increasing their chances of survival and post-fledging success.

Herring River Restoration Project – The Herring River restoration project impacts nearly 1,000 acres and over 6 miles of tidally restricted estuaries along the Herring River in the towns of Wellfleet and Truro. The goal of the project is to restore the natural tidal flow and salt marsh/estuarine habitat altered over 100 years ago. While still a work in progress, salt marsh- and tidal creek-dependent species such as common and roseate terns are expected to benefit directly through an increase in feeding opportunities (primarily estuarine fish) and resting (on exposed flats) in the Herring River. Tidal restoration would also restore wetland and open-water habitats used by resident and migratory shorebirds including red knots for feeding and resting. Increased food availability would positively affect energy conservation (increased fitness for breeding, staging and migrating), including enhancing food availability for young shorebirds thus increasing their chances of survival and post-fledging success.

Monomoy National Wildlife Refuge Draft Comprehensive Conservation Plan – The US Fish and Wildlife Service released a draft plan and environmental assessment in 2014 for public and agency review. Although the plan is not final and actions may change in the future, the release of the draft plan is sufficient to include proposed actions related to shorebirds in our analysis of cumulative impacts. The following management actions in the preferred alternative for the Draft Comprehensive Conservation Plan are considered:

- Increase actions to protect and manage upland, dune and beach habitats and help recover federally listed species such as the roseate tern, piping plover, red knot, and northeastern beach tiger beetle.
- Potentially expand predator management when and where necessary to protect nesting birds of concern.
- Increase habitat management for common terns (75 acres instead of 30 acres) and roseate terns (10 acres instead of 2 acres).

- Closing available high quality habitat to the public. Timing and locations of seasonal closures would vary year to year based on wildlife use and habitat.
- Expand the area of seasonal closures of marsh and intertidal habitat to protect nesting, migrating, and staging birds. Timing and locations of would vary from year to year based on wildlife use and habitat.
- Prohibit dogs and other pets from all areas of the refuge (currently leased pets allowed on Morris Island properties.)
- Prohibit beach sports, grilling, kite flying, jet skis, and other activities that are not wildlife-dependent.

Since pedestrians, pets, and aerial recreational activity can disturb and displace breeding, feeding and sheltering shorebirds, these additional seasonal restrictions would benefit shorebirds. The additional bans and restrictions on visitor use would have an adverse impact to visitors that enjoy these activities.

Nauset Spit: The Town of Eastham – The Town of Eastham has recently begun enforcing a town bylaw that prohibits driving on the beach south of Coast Guard Beach, in particular on the last mile of Nauset Spit in Eastham. This approximately 1-mile section of ocean beach and intertidal marsh is prime habitat for breeding, feeding and sheltering shorebirds. Up until this current enforcement effort, the area had a high volume of ORV use and recreational activity, especially at the distal tip. This enforcement effort reduces the volume of human activity on this 1 mile of beach, therefore having an adverse impact on recreationalists. However this will reduce disturbance and displacement to breeding, feeding and sheltering shorebirds and prevents negative impacts to the beach ecosystem (see above impacts to wrack and vegetation). This section of beach supports several pairs of nesting piping plover as well as least terns and other beach-dependent species. The distal tip is an important resting and feeding area for thousands of migrating shorebirds, most notably the federally endangered roseate tern and federally threatened red knot. The continued enforcement of the Eastham town bylaw and resultant lack of vehicles will benefit these special status species.

Town of Orleans Piping Plover Habitat Conservation Plan (HCP) (2015) – US Fish and Wildlife Service has permitted the Town of Orleans to increase access for over-sand vehicles (OSV) on Nauset Beach South when unfledged piping plover chicks are present on this section of beach. The town will take steps to avoid “take” and make up for effects to plover chicks. The Service has issued a three-year incidental take permit under the Endangered Species Act, which after July 15 authorizes the passage of 180 self-escorting vehicles past two broods of piping plovers (up to eight chicks) within each of two 2-hour periods, each day. In addition, the town has proposed mitigations to offset these actions including nonlethal predator management, public outreach and education programs, and off-site management and/or monitoring to contribute to a conservation fund managed by the Massachusetts Division of Fisheries and Wildlife to increase productivity of piping plovers on State beaches through selective predator management. As outlined in the Orleans’s HCP, according to MassWildlife National Heritage and Endangered Species Program (NHESP), the state and federal governments do not anticipate receiving more than two incidental take permits in Massachusetts for 2015, i.e., the town of Orleans and the national seashore. Although no other permit applications have yet been filed, it is likely that if the Town of Orleans is successful with its habitat conservation plan, more towns would follow in the future.

As a result of the Orleans HCP, up to 180 vehicles/day will have access to drive on roughly four miles of beach that in years past was closed to vehicle access when there were unfledged shorebird chicks on the beach. This will have a beneficial effect on recreationalists. Potential impacts include

increased levels of displacement and disturbances to feeding and resting adults and chicks, and harming, harassing and killing of up to eight piping plover chicks. If least terns nest in this area, they would also likely be affected by the increase in vehicle activity and human presence on these beaches.

AFFECTED ENVIRONMENT AND IMPACT ANALYSIS

SHOREBIRDS' AFFECTED ENVIRONMENT

This section describes the existing conditions with regard to the special status shorebirds that are the focus of this management plan, This description also incorporates the likely effects of climate change on the affected environment of these shorebirds.

Piping Plover (Federally Threatened, State Threatened)

The national seashore comprises a portion of the New England Recovery Unit as described in the *Piping Plover Recovery Plan* (USFWS 1996). This regional recovery unit has exceeded (or been within three pairs of) its 625-pair abundance goal (or minimum desired subpopulation size recommended for long-term viability of the species in this recovery unit) since 1998, attaining a post-listing high of 753 pairs in 2009 and 2010 (USFWS 2011a) (table 2), but has not yet reached the productivity goals or other delisting criterion. Approximately 33% of the Atlantic coast population of piping plovers (593 of 1,849 pairs in 2009 and 591 of 1,782 pairs in 2010) and over 75% of piping plovers in the New England Recovery Unit (593 of 753 pairs in 2009 and 591 of 753 pairs in 2010) nest in Massachusetts (USFWS 2011a) (table 6). The national seashore accounts for approximately 14.4% of the number of pairs in Massachusetts (85 of 591 pairs in 2010).

For the five-year period ending with 2014, the average productivity for piping plover at the national seashore was 0.84 chicks fledged/pair/year, which is the second lowest it has been at the seashore since 1989 (with 2013 being the lowest). Since 2000, the five-year annual productivity has narrowly reached the recovery goal four times in the past 15 years (table C-1, appendix C). When viewed over a 20-year period (1995–2014), the five-year weighted average annual productivity has declined significantly by 0.0426 chicks/pair/year ($p < 0.0001$, $F_{1,18} = 36.14$, $r^2 = 0.6675$) (figure C-2, appendix C). The number of nesting pairs within the national seashore has not drastically changed in recent years (68 to 99 pairs from 2001–2014) however, productivity is in great decline (trending downward with 25-year lows of 0.30 chicks fledged/pair in 2012, 0.54 chicks fledged/pair in 2013 and 0.76 chicks fledged/pair in 2014) and the USFWS recovery goal of a five-year average annual productivity of 1.5 fledged chicks/pair/year is not being achieved. This statistically significant negative trend of productivity is driven by high levels of predation on national seashore beach habitats, particularly by American crows, Eastern coyotes, and red fox (NPS 2014 Shorebird Monitoring and Management, Cape Cod National Seashore Annual Report. Wellfleet, MA).

TABLE 2. REGIONAL AND NATIONAL PIPING PLOVER ABUNDANCE AND DISTRIBUTION FROM 1998 TO 2010

	Pairs												
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Maine	60	56	50	55	66	61	55	49	40	35	24	27	30
New Hampshire	5	6	6	7	7	7	4	3	3	3	3	5	4
Massachusetts	495	501	496	495	538	511	488	467	482	558	566	593	591

TABLE 2. REGIONAL AND NATIONAL PIPING PLOVER ABUNDANCE AND DISTRIBUTION FROM 1998 TO 2010

	Pairs												
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Rhode Island	46	39	49	52	58	71	70	69	72	73	77	84	85
Connecticut	21	22	22	32	31	37	40	34	37	36	41	44	43
New England Recovery Unit	627	624	623	641	700	687	657	622	634	705	711	753	753
New York / New Jersey Recovery Unit	338	350	401	431	507	530	519	485	538	586	554	542	498
Southern Recovery Unit	203	182	183	208	209	203	245	300	321	333	331	302	306
US Total	1,168	1,156	1,207	1,280	1,416	1,420	1,421	1,407	1,493	1,624	1,596	1,597	1,557
Atlantic Coast Total	1,379	1,392	1,437	1,530	1,690	1,676	1,658	1,624	1,749	1,890	1,849	1,849	1,782

(Source: USFWS 2011)

Note: The Southern Recovery Unit region includes Delaware, Maryland, Virginia, North Carolina, and South Carolina. The difference between the US Total and the Atlantic Coast Total is the addition of the number of pairs from eastern Canada (not shown).

Roseate Tern (Federally Endangered, State Endangered)

The Northwest Atlantic roseate tern population is listed as endangered by the US Fish and Wildlife Service and the Massachusetts Department of Fish and Wildlife and has experienced a 25% population decline since 2000, with fewer than 3,100 adult breeding pairs remaining (USFWS 2010). Approximately 90% of the Northwest Atlantic population is concentrated at just three nesting colonies at Great Gull Island, New York (1,413 pairs); Bird Island, Marion, Massachusetts (708 pairs); and Ram Island, Mattapoisett, Massachusetts (588 pairs) (2009 peak period estimates) (USFWS 2010). The only other nesting colonies in Massachusetts are at Penikese Island (43 pairs in 2009) and Monomoy National Wildlife Refuge (South Monomoy and Minimoy Island) in Chatham (45 pairs in 2007) (USFWS 2010).

Although roseate terns have not nested at the national seashore since 2001, the available habitats represent some of the most important staging and roosting areas for roseate terns on Cape Cod (Hadden 2001; Trull et al. 1999). Earlier studies by Trull et al. (1999) identified 20 sites around Cape Cod where roseate terns (and common terns) staged during daylight hours between mid-July through mid-October with some sites supporting thousands of roseate terns (figure 4). Current data suggest that the entire northwest Atlantic breeding population of roseate terns may be staging in southeastern coastal Massachusetts. Large flocks of greater than 1,000 terns (consisting of high percentages of roseate terns) are commonly seen at the Hatches Harbor Complex, Nauset Marsh Complex, Race Point North, and Race Point South. High counts and banding studies show that potentially 63% to 93% of all roseate terns (adults and juveniles) are present simultaneously at sites

within the national seashore during August to September (best estimate by Massachusetts Audubon and J. Spindel [USGS] based on data provided in NHESP 2011 report and Jedrey et al. 2010).

Additionally, recovery goals for the roseate tern are not being met. One possibility for this lack of population recovery may be that they are experiencing post-fledgling survival limitations while they feed and rest during migration at the national seashore. To test this theory, a detailed, NPS-funded, three-year study on the importance of the national seashore to staging roseate terns began in 2014. This study further investigates work done by Massachusetts Audubon and US Geological Survey on the geographic and temporal variation in staging site use by roseate terns within the national seashore, quantify the rates and types of disturbances that staging terns encounter, and documents any effects that disturbances might have on roseate tern behavior.

Red Knot (Federally Threatened)

The red knot has recently been listed as a threatened species under the Endangered Species Act, critical habitat designation is currently being proposed and evaluated by the US Fish and Wildlife Service. Red knots are species of highest priority for the North Atlantic region under the *U.S. Shorebird Conservation Plan - North Atlantic Regional Shorebird Plan* (Clark et al. 2000) and are recognized as a migratory target species of greatest conservation need in the Massachusetts 2005 Comprehensive Wildlife Conservation Strategy (MADFW 2006). The North Atlantic region is important for red knots during both spring and fall migrations. Red knots occur during fall migration (mid-July through September) throughout Massachusetts. Major fall stopover areas include: Third Cliff in Scituate, Plymouth Beach, Duxbury Beach, Monomoy National Wildlife Refuge, South Beach in Chatham, and Nauset Marsh in Eastham (MADFW 2006).

The national seashore provides important staging and foraging habitat for red knots. From 2008 through 2010, flocks of 350–1,000 red knots were recorded on stretches of ocean beach within the administrative boundary of the national seashore including North Pleasant Bay (encompassing beach and flats from Sampson Island down to the south end of North Beach Island) and South Pleasant Bay (encompassing beach and flats of South Beach) from July through October (Harrington et al. 2010; unpublished field observations USFWS, Eastern Massachusetts NWR Complex, MA).

In addition, through formal and informal observations, the greatest numbers of red knots have historically been observed at Coast Guard Beach in Eastham and within Nauset Marsh, although over the past three years, hundreds have been observed along the ocean beach in Truro (Armstrong area within Race Point South). In 2000, 360 red knots were recorded at Coast Guard Beach in Eastham (Hadden 2001), and in 2012, 200 red knots were observed foraging throughout sections of Race Point South for two weeks in August. In 2013, red knots were observed in Nauset Marsh in August and September, with a high of 326 individuals recorded on August 18 (2013 MAS, unpublished field observations) and 200 individuals were observed at Armstrong on August 22 (National Seashore 2013). In 2014, 100 to 120 red knots were regularly observed at Coast Guard Beach in Eastham and a flock of 35 were regularly observed at Race Point. In addition, as part of a long-term study to identify important migration stop-over sites throughout Cape Cod and on their wintering grounds, scientists from the US Fish and Wildlife Service captured and affixed tracking devices to five red knots at Coast Guard Beach in Eastham.



(Source: USFWS 2010, originally prepared by E. Jedrey of the Coastal Waterbird Program of the Massachusetts Audubon Society)

FIGURE 4. ROSEATE TERN STAGING SITES IN SOUTHEASTERN COASTAL MASSACHUSETTS, INCLUDING CAPE COD NATIONAL SEASHORE. SITES INCLUDED 1,000 OR GREATER MIXED TERNS PRESENT WITH A LARGE PERCENTAGE OF ROSEATE TERNS ON A REGULAR BASIS DURING THE POST BREEDING PERIOD

[Note: Green outline depicts the national seashore boundary.]

Least Tern (USFWS Conservation Concern, State Special Concern)

The least tern is listed by the Massachusetts Department of Fish and Wildlife as a species of special concern and as a bird of conservation concern by the US Fish and Wildlife Service. The *North American Waterbird Conservation Plan* lists the least tern as a species of high concern (Kushlan et al.

2002). Regionally, the breeding population of least terns increased from the 1970s to the 1990s from an estimated population of 15,190 in the 1970s to 16,018 in the 1990s (MANEM 2006). Least terns in Massachusetts increased from 1985 through 2001, declined for several years and then increased sharply after 2006. From 1985 to 2001, the population size in Massachusetts declined subsequently, and increased sharply after 2006. Since 1985, numbers have ranged from 2,109 to 4,309 pairs with a mean of 2,914 pairs (Mostello 2013).

In 2013, Massachusetts provided habitat for over 40% of the total 8,854 pairs of least terns from Virginia to Maine (K. O'Brien, pers. comm. USFWS 2014). It must be emphasized that because initial counts were often performed with inferior survey techniques and less inclusive survey coverage area early increases in observed numbers do not necessarily indicate increasing populations (Thompson et al. 1997). Furthermore, because least terns are relatively long-lived, the effect of poor productivity on population status is delayed. Thus, annual reproductive success is just as critical an indicator of least tern population stability as annual numbers of individuals counted (Thompson et al. 1997).

In the mid-1970s through 1980s, the number of nesting pairs of least terns at the national seashore generally ranged from 200 to 600 pairs. Over the past 10 years (2005–2014), the number of nesting pairs of least terns has fluctuated with 2014 being the lowest with 77 pairs to a high of 268 in 2011. In 2014, the number of nesting least terns within the national seashore declined by nearly half compared to 2013 (77 and 136, respectively). Productivity has varied at the national seashore but has generally been poor with less than one chick fledged/pair. Since 2002, productivity has been less than 0.45 chicks fledged/pair (for example in 2014, only 7 chicks fledged from 77 nesting pairs (0.09 chicks fledged/pair). This low productivity within the national seashore is due primarily to intense predation on eggs and chicks, mainly by coyotes.

Common Tern (State Special Concern)

The common tern is listed by the Massachusetts Department of Fish and Wildlife as a species of special concern. From 1985 to 2003, common tern numbers rose fairly steadily in Massachusetts. Since then, however, the population seems to have stabilized (with the exception of 2012) at about 16,000–17,000 pairs. Since 1985, population size has ranged from 6,483 to 16,760 pairs (mean, 12,643 pairs). In 2013, 16,336.5 pairs of common terns nested at 28 sites in Massachusetts. The South Monomoy Island common tern colony (7,526 pairs) dwarfed all other colonies in the state. The next-largest colony was Ram Island (3,525 pairs), Bird Island (2,500 pairs), and Plymouth Beach (1,026 pairs) (Mostello 2013).

Over the past 10 years at the national seashore, a few common tern pairs (<10) have nested within or near least tern colonies at Jeremy Point, Coast Guard Beach in Eastham, Race Point North, and Wood End but the majority of nesting has historically occurred on New Island, Orleans (in 1999, 2,176 pairs nested on this small island). This number sharply declined by over 50% in both 2000 and 2001 (to 1,078 and 495 pairs, respectively) and productivity was low due to intense egg predation from coyotes, gulls, striped skunks, and ants. In 2002, for the first time in 20 years, common terns did not nest on New Island (Peter Trull, pers. comm.). More recently, nine pairs attempted to nest on New Island in 2009, but all nests were lost to predation. From 2009 to 2013, one or two pairs unsuccessfully nested on New Island each year. Common terns did not nest at the national seashore in 2014.

American Oystercatcher (USFWS Conservation Concern)

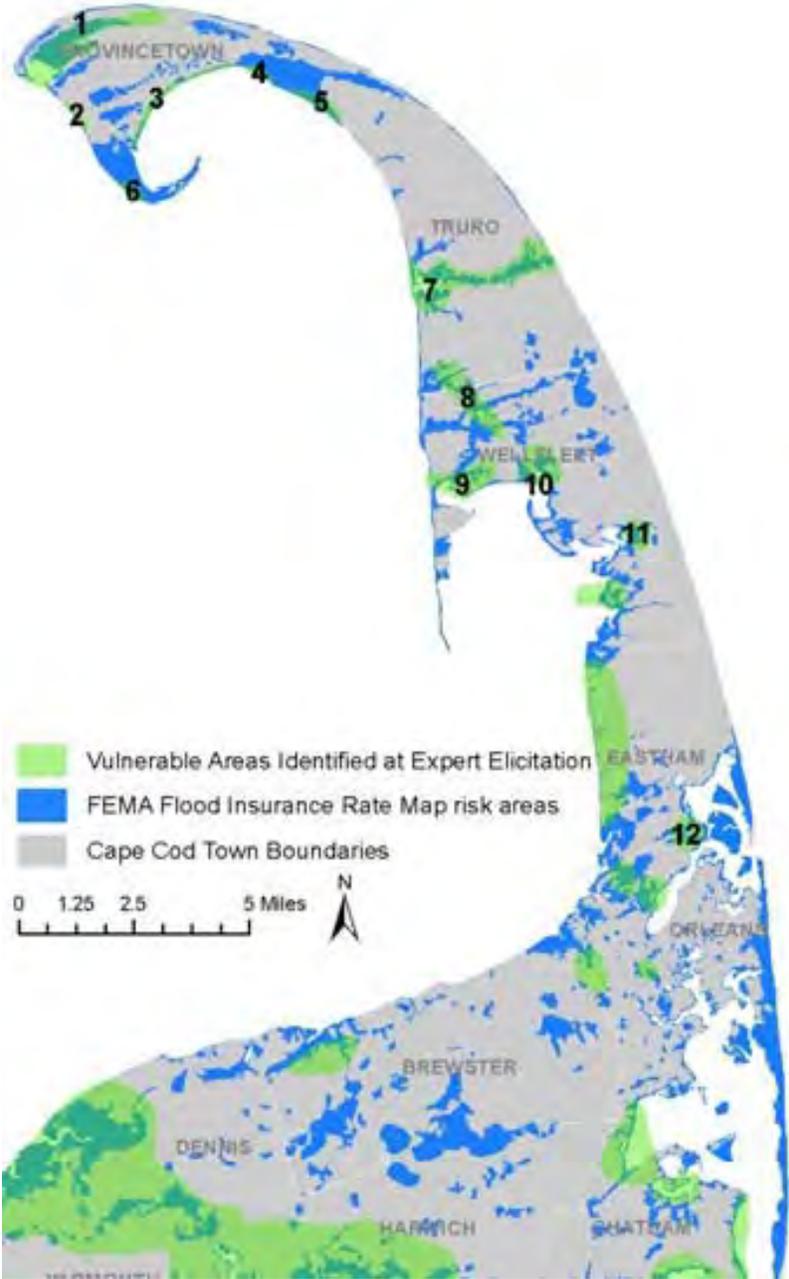
The *U.S. Shorebird Conservation Plan* (Brown et al. 2001) lists the American oystercatcher as a species of high concern with threats during the breeding season (Brown et al. 2001) and is considered by the US Fish and Wildlife Service as a bird of conservation concern in the United States (USFWS 2008a). Although not listed in Massachusetts, the American oystercatcher is recognized in the Massachusetts 2005 Comprehensive Wildlife Conservation Strategy (MADFW 2006) because of its inclusion in the *U.S. Shorebird Conservation Plan* (Brown et al. 2001).

American oystercatchers on the Atlantic and Gulf coasts have a population size of approximately 11,000 birds (Brown et al. 2005). In Massachusetts, a statewide census conducted in 2004 estimated 189 pairs of American oystercatchers at 58 sites, with the largest numbers on Nantucket, Martha's Vineyard, Monomoy National Wildlife Refuge in Chatham, and the Boston Harbor Islands (MADFW 2006). More recent pair numbers in Massachusetts include 185 pairs in 2005, 191 pairs in 2006, 201 in 2007, and 197 in 2008 (Murphy 2010). There are current conservation actions occurring in Massachusetts for American oystercatchers including predator control, monitoring, and human disturbance management (Schulte et al. 2010). At the national seashore, over the last 10 years (2005–2014), a total of 33 American oystercatchers nested, (range = 2-5 nesting pairs/year) with productivity of 0.26 chicks fledged/pair. American oystercatchers have nested at Jeremy Point, Coast Guard Beach (Eastham), and New Island, Orleans. Nesting American oystercatchers are experiencing extremely low to no productivity due to intense predation on eggs and chicks, mainly by coyotes.

INFLUENCE OF CLIMATE CHANGE ON SHOREBIRDS

In July 2010, national seashore staff participated in an expert workgroup to identify areas on Cape Cod, including the national seashore, which are vulnerable to the anticipated impacts of climate change. The consensus-based workgroup evaluated vulnerability of a location based on elevation, susceptibility to erosion, and exposure to storm surges and sea level rise. Figure 5 depicts areas within or adjacent to the national seashore identified as vulnerable areas.

In general, Cape Cod shorebird habitats would be negatively affected by climate change, which is anticipated to affect temperature, precipitation, frequency and intensity of extreme events (storms and drought), and accelerated sea level rise. Piping plovers, terns, and American oystercatchers are obligate coastal species, using low-lying coastal habitats for breeding, feeding, and sheltering. Red knots are obligate coastal species in migration. This makes these shorebirds vulnerable to effects of climate change, particularly sea level rise. Narrowing beaches due to accelerated erosional processes causes flooding and more frequent overwash, which can destroy habitat and nests and result in shorebird mortality (adults and chicks). In rare instances, storms can be beneficial by removing vegetation on beaches, enhancing suitable nesting and roosting habitat for piping plovers, least terns and American oystercatchers.



(Source: Cape Cod National Seashore (CCNS) Climate Change Action Plan [NPS 2010b])

FIGURE 5. AREAS VULNERABLE TO CLIMATE CHANGE IMPACTS IN OR NEAR CAPE COD NATIONAL SEASHORE

As beaches narrow, the lack of dry beach, especially at high tide, forces beachgoers and the highly mobile plover broods to come in close contact with one another, increasing the frequency and probability of human disturbance. Narrow beaches may also funnel predators to hunt in bird nesting area that they may not have encountered on a wider beach. While the specific long-term impacts are difficult to predict, these factors can generally be expected to adversely affect shorebird habitat, and prolong the nesting season (due to re-nesting when nests are lost to storms) which may reduce productivity. In addition, the effects of ocean acidification on shellfish are already manifesting themselves and will magnify up the food web affecting the availability of some food sources. This is potentially serious, since some shorebirds (e.g., American oystercatchers) depend on foraging for shellfish and other marine organisms. In addition, the ability of these shorebirds to adjust to rising sea levels is relatively unknown. The negative effects of climate change are likely to be similar for migrating shorebirds and seabirds such as red knots and roseate terns that rely on these same coastal habitats for resting and foraging during long migrations to South America.

INFLUENCE OF PREDATION ON SHOREBIRDS

The overarching threat to rare shorebirds throughout their range is loss or degradation of habitat; however, predation can also be a major influence on reproductive success and may also remove adults from the population (USFWS 2009a). Ground-nesting shorebirds like piping plover, terns, and American oystercatcher are highly susceptible to predation, due in part to the narrow or eroding coastal habitat where they live; modeling of red fox movements indicated increased nest predation risk for ground-nesting bird species in strip habitats (Seymour et al. 2004). Predation risk also increased in narrow habitats which are sensitive to changes in width by even a few meters (Seymour et al. 2004). There is evidence that barrier beach systems have become unsuitable breeding habitats for ground-nesting species due to human encroachment, habitat destruction, and invasion of mammalian predators (Erwin 1980; Rounds et al. 2004).

Some predator populations in coastal areas have increased to artificially high levels due to range expansion and, in some cases, their ability to adapt and benefit from human-provided foods (e.g., food from human sources, such as food scraps left on the beach or intentional feeding) (NPS 2014). These “subsidized” predators often reach populations beyond the natural capacity of the landscape, and exert unnaturally high levels of predation pressure on many species, including ground-nesting shorebirds (NPS 2014). At the national seashore, Eastern coyotes and other mammals may be attracted to the smells of garbage, food wastes and storage, and food cooking associated with human recreation near shorebird nesting areas. Fish remains left on the beach by fishermen or food scraps left by beachgoers also attracts Eastern coyotes, crows, and gulls to shorebird nesting areas.

Currently in the national seashore, species recovery objectives are not being achieved for piping plover as the five-year weighted average recovery goal has been met only four of 15 years and there is a statistically significant negative trend of productivity driven by high levels of predation on national seashore beach habitats, particularly by American crows, Eastern coyotes, and red fox. Nesting least terns and American oystercatchers are also experiencing extremely low to no productivity due to intense predation on eggs and chicks, mainly by coyotes. This trend has accelerated in recent years, as follows:

- (1) In 2014, 70% of piping plover nest loss within the national seashore was due to predation and from 2005 through 2014, the leading cause of nests lost to predation has been to American crows (42%), unknown predator (unable to identify species) (27%), and Eastern coyotes (23%) (nests lost to unknown predators were instances where wind and rain prevented predator identification via tracks in the sand).

(2) In 2013, only two least tern chicks fledged from 136 nesting pairs (0.01 chicks fledged/pair), in 2014, only seven chicks fledged from 77 nesting pairs (0.09 chicks fledged/pair), and predator tracks of Eastern coyote and American crow were observed daily throughout the least tern colonies.

(3) In 2013, 10 American oystercatcher nests were recorded with four lost to Eastern coyote predation, four lost to overwash, and two lost to unknown causes, there was no productivity. In 2014, two pairs of American oystercatchers nested at the national seashore; a total of four nests were laid, Coyote predation was the main cause of egg and likely chick loss, there was no productivity. The last American oystercatcher nest that successfully hatched and fledged chicks was in 2008.

SHOREBIRDS IMPACT ANALYSIS

METHODOLOGY

Impacts on special status species of shorebirds are based on one or more the following criteria: (1) the known or likely occurrence of the species or its preferred habitat within the national seashore; (2) use of the national seashore habitat for breeding (i.e., courtship, territorial displays, nesting) and fledging behavior; and/or (3) use of the national seashore habitat for feeding or sheltering (i.e., resting or staging behavior during migration).

Generalized categories of effects and types of actions analyzed herein include: (1) changes in using symbolic fencing on approximately 27 miles (of national seashore beach (with exclusion of selected life-guarded beaches), ORV corridor, Pole Line Road/Inner Dune Route, and at parking lots; (2) changes due to use of flexible management (reduced protection for a few nesting pairs of piping plovers on high-visitor use areas); (3) changes due to use restrictions and closures (seasonal closures of recreation on habitat used by breeding, feeding, or sheltering shorebirds); (4) changes due to application of education and outreach (website, visitor center, pamphlets/flyers, field signs); and (5) changes in the management of predator impacts (shorebird productivity and the recent decline of nesting pairs, reduced length of nesting/fledging season).

Resource-specific context for assessing impacts of alternatives to special status shorebirds includes:

- These species are protected by international, federal, and state laws, meaning that their protection is significant on an international, national, regional, and local scale.
- NPS *Management Policies 2006* and Director's Order 77: *Natural Resource Protection* directs the National Park Service regarding protected species management in park units.
- The presence of special status shorebird species is an important component of the visitor experience.
- Maintaining the integrity of listed species habitat is important because the habitats are rare and vital to beach-dependent shorebirds.

IMPACTS OF ALTERNATIVE A: NO ACTION

Under alternative A, there would be no changes in shorebird management; therefore, existing trends would be expected to continue. Annual and five-year average productivity of nesting shorebirds in the national seashore would likely fluctuate but would be expected to remain low and the generally declining trend in productivity would likely continue.

Cumulative Impacts. Alternative A does not result in any changes to existing conditions for shorebirds; therefore, there are no cumulative impacts.

Conclusion. Alternative A would continue current management actions with regard to shorebirds in the national seashore. There would be no changes in the existing conditions of shorebirds and shorebird productivity; therefore, current trends would continue.

ALTERNATIVE B: INCREASED PROTECTION AND FLEXIBLE MANAGEMENT PLUS ADDITIONAL MANAGEMENT OF PREDATOR IMPACTS (NPS PREFERRED ALTERNATIVE)

Alternative B would implement an integrated, comprehensive, and adaptive management plan to conserve special status shorebird species. This approach would include, among other measures, managing predator impacts through lethal, selective predator removal, as needed. This alternative combines some additional recreational use restrictions related to shorebird management and protection with additional recreational opportunities offered.

Under alternative B, less of the life-guarded beaches would be symbolically fenced (portions or all of the six life-guarded beaches and up to 7,052 feet under alternative B compared to four life-guarded beaches and 3,960 feet under alternative A). The use of flexible management could be increased to five pairs with a reduced buffer at life-guarded beaches, parking lots, and Pole Line Road and Inner Dune Route. These changes are proposed to provide more consistent recreational opportunities at these high use locations. Shorebirds may arrive in these high use areas and nest prior to peak visitation season (beginning in June). As visitors arrive, the nesting shorebirds can be disturbed and displaced causing the pair to abandon nests and relocate to an area of beach with fewer disturbances. If this first nesting attempt fails, piping plovers will re-nest up to six times during the breeding season. Although re-nests provide additional opportunities for the birds to successfully hatch and fledge chicks, re-nesting causes an energetic strain on adults and prolongs the nesting season. In addition, nests laid later in the season, often result in lower productivity due to increased predator pressures (i.e., loss of eggs and chicks) because predators are not only looking for food to feed themselves, but also for their offspring. There would also be an increased likelihood of disturbance and displacement to the adults, eggs, and chicks due to higher visitation to the park during the peak summer season.

Flexible management would be increased to five pairs of piping plovers on selected life-guarded beaches, parking lots, Pole Line Road, and Inner Dune Route. The increased flexible management and excluding symbolic fencing from life-guarded beach areas (longer unprotected beach segments as compared to alternative A) would result in less potential habitat available to support breeding, feeding, or sheltering shorebirds, and potentially increased nest abandonment in these areas. Because no or very few fledglings would likely be produced on the six life-guarded beaches, there would be little or no contribution to least tern populations or to recovery goals for piping plover.

ORVs can have adverse effects to piping plovers and other ground-nesting shorebirds, including crushing eggs and chicks, degrading habitat, disrupting normal behavior patterns, crushing wrack into the sand (making it unavailable as cover or a foraging substrate), creating ruts (can trap or hinder movements of chicks), preventing habitat use that is otherwise suitable, decreasing brood foraging behavior, and killing vegetation. Increasing the width of the ORV corridor where the beach is wide enough to accommodate the corridor is anticipated to have a minimal to no adverse effect on shorebirds. "Drive through only" corridors would need to meet additional restriction or corridors may be temporarily closed, which would benefit nesting shorebirds through reduced encounters.

Under alternative B, the national seashore would continue using nonlethal methods of reducing predator impacts including predator exclosures (as described in alternative A to protect piping plover nests) plus electric fencing (primarily to protect terns) where practical as methods to reduce predation on nesting adults, chicks, and eggs from predators. However, predator exclosures cannot be used for terns or American oystercatchers and do nothing to protect piping plover chicks after they leave the safety of the exclosure and have inherent risks (adult piping plover mortality, nest abandonment, and predators keying in on exclosures, etc.).

Under alternative B, experienced USDA APHIS Wildlife Services staff would lethally remove individual predators on sections of beach with historically high shorebird activities that are experiencing low productivity due to predation. The specific predator species, number of individuals removed, and locations of removal would likely vary year to year according to the results of monitoring data collected in the previous years and during the current nesting season. This would result in increased adult and egg survival, less nest abandonment, greater chick survival, likely a shorter nesting season (due to less re-nesting), and greater contribution to special status shorebird species productivity and recovery (see appendixes C and D).

Lethal selective predator management leads to higher productivity for shorebird populations as reported in detail in appendix D, supported by research from several managed shoreline habitats in the region. For example, Parker River National Wildlife Refuge, on Plum Island in Newburyport, Massachusetts, manages breeding piping plover populations on approximately 6 miles of refuge beach. The refuge contracted with USDA APHIS from 2008 to 2010 to conduct three years of predator control. Following these three years of predator management predation events reached an all-time low, with zero nests being depredated and chick survival climbing to 75%. In 2011–2012, when the refuge discontinued predator management, the probability of nest depredation increased and chick survival decreased (Pau 2014) (figure D-1).

The US Fish and Wildlife Service conservatively estimates that in areas where selective predator removal is implemented, the long-term average productivity of special status shorebird species could increase by 20% (USFWS 2010). In addition, the US Fish and Wildlife Service, which administers the Endangered Species Act, recommends that selective predator removal be a component of the national seashore's future management plan to offset potential reduction in productivity of the flexible management program (5/2010 CCNS BO).

Under alternative B, the national seashore staff would evaluate a variety of options to enhance trash management beyond the NPS carry-in/carry-out policy as presented under alternative A. Enhanced refuse management that reduces or eliminates garbage discarded on beaches or is otherwise accessible to predators, would result in fewer predators foraging in shorebird nesting habitat and may increase the potential for fledging chicks, helping to increase levels of annual and five-year average productivity for shorebirds within the national seashore.

Under alternative B, pet closures would occur earlier and longer on more selected beaches than described under alternative A. In addition, Hatches Harbor (including the marsh and spit) and sections of Herring Cove would be closed to pets from April 1 through October 15 (dates may be earlier or later reflecting shorebird arrival/departure annually) when breeding, feeding, and sheltering shorebirds are observed. Pets (leashed and unleashed) cause a predator escape behavior by shorebirds (see appendix C). A Cape Cod study (USFWS 1996) determined that piping plovers were disturbed by pets at approximately 150 feet; plovers reacted by moving approximately 185 feet from pets. In 2014, there were 597 incidents of dogs off-leash documented by national seashore shorebird staff. Closing or otherwise restricting beach and shoreline access to pets would prevent adults, eggs, and chicks from being eaten and adult birds from flushing off nests, exposing eggs and chicks to the elements, which can cause death, abandon nest sites, and flush from resting and foraging sites. These management actions would help to increase annual and five-year average productivity for shorebirds within the national seashore over current levels, contribute to the recovery goals for piping plover and other special status species, help to increase post-fledging survival, and help shorebird flocks be better prepared by allowing them to rest and feed, increasing their fitness and chances for survival during long migratory flights.

In addition to seasonally prohibiting the aerial recreation activities of kitesurfing on all open-ocean and bayside waters as described under alternative A, alternative B would also ban paragliding or hang gliding for the entire national seashore from March 15 to October 15, resulting in shorebirds exhibiting less displacement behavior from perceived aerial threats (described under alternative A), which would disturb adults and expose eggs and chicks to the elements and potentially to predators. This action would also allow shorebirds to feed and shelter (including migrating and staging shorebirds) with fewer disturbances from aerial recreation sources.

Under alternative B, additional restrictions would be implemented to provide additional protection for staging and migrating shorebirds. Historically important migratory bird staging and feeding areas, the marsh side of Hatches Harbor, and the northern tip of Herring Cove, and some narrow sections of beach, channels, and mud flats would be closed to pedestrians and boats resulting in less disturbance to migrating shorebirds. In addition, these restrictions could also occur on other beaches when concentrations of more than 100 staging and migrating shorebirds are regularly present. Temporary closures of bay, spits, mud flats, and ocean beach sections to pedestrians and boats from July 15 through October 15 would likely result in less shorebird displacement from this habitat. Pedestrians and boaters are perceived as threats by shorebirds (see appendix C); therefore, the reduction in disturbance related to these management actions under alternative B would allow birds to feed and rest, positively affect energy conservation (fitness for migration and successful over-wintering), allow feeding of young, protect cohesion of family groups, increase survival of young helping to increase post-fledging success, and enhance the ability of sites to support shorebirds staging for migration.

Cumulative Impacts. Actions outside the national seashore and within the surrounding region that would have an effect on shorebirds include the Cape Cod Master Plan – Water Quality / Restoration: Clean Water Act (section 208), the Herring River Restoration Plan, the *Monomoy National Wildlife Refuge Comprehensive Conservation Plan*, the town of Eastham’s enforcement of the ORV ban, and the Town of Orleans Habitat Conservation Plan. The water quality plan and Herring River restoration plan would benefit shorebirds by general improvements in quality and availability of habitat. The comprehensive conservation plan and ORV ban would also have beneficial effects to the shorebirds. The Habitat Conservation Plan would adversely affect a small number of shorebirds through incidental take as a result of opening additional beach to ORV use. Together, the impacts of these other actions are likely to be beneficial, as the general habitat improvements would outweigh the incidental take. Alternative B would contribute both very localized adverse impacts at high use areas, and seashore-wide beneficial impacts. In conjunction with the impacts of these other actions, the overall cumulative impacts would be beneficial, with alternative B contributing a beneficial increment due to increased productivity of nesting shorebirds and post-fledging survival of staging/migrating shorebirds.

Conclusion. Overall, alternative B would greatly benefit shorebird populations in the national seashore. The number of nesting shorebirds and their annual and five-year weighted average productivity would be expected to increase and reverse the current declining trend (as described in appendix C) due mostly to lethal removal of individual or small groups of predators foraging in nesting areas (i.e., American crows, Eastern coyotes, and red fox) by experienced USDA APHIS Wildlife Services staff. Hence, piping plover productivity would likely equal or exceed USFWS recovery goal of a five-year average annual productivity of 1.5 fledged chicks/pair/year and lead to increased levels of annual recruitment.

Similarly, productivity of least terns (77–371 nests/year from 2002–14) and American oystercatchers (2–5 nests/year from 2002–2014) would be expected to increase greatly above the current very low levels (0.01-0.089 [2002–2014, table C-8] 0-1.0 [2002–2014, table C-10]), respectively. Shorebird

nesting/fledging season may be shortened due to lethal selective predator management (i.e., reducing the need for adult pairs to renest due to predation of eggs and chicks). Chicks that fledge earlier in the season will also have a longer time to prepare for migration (gain fat reserves, build stronger flight muscles) for their migration in late summer which would increase survival of these first year birds.

Alternative B would also contribute a noticeable beneficial increment to cumulative impacts in combination with other efforts to increase protection of shorebirds and enhance shorebird habitat.

Alternative B would result in substantial beneficial impacts on shorebirds due to a reversal in the current productivity decline for nesting shorebirds, and reduced disturbance to migrating and staging shorebirds. These management actions maintain the integrity of the species and their habitat and increase protection on a regional and local scale.

IMPACTS OF ALTERNATIVE C: CURRENT MANAGEMENT ACTIONS PLUS ADDITIONAL MANAGEMENT OF PREDATOR IMPACTS

Under alternative C, current management guidance and actions, as described under alternative A, would remain in place with two additions described under alternative B:

1. the options to use electric fencing and selective lethal predator management
2. the same restrictions for distance from shorebird nesting areas for airborne devices like remote/radio control airplanes and closure to aerial recreation activities (e.g., kiteboarding/kitesurfing, paragliding/hang gliding,) from March 15 to October 15.

There would be no change in existing conditions with regard to disturbance and reduced productivity of nesting shorebirds at the lifeguarded beaches and along the ORV corridor, as there would be no changes in management actions in these areas. However, alternative C would increase protection of breeding, feeding, and resting shorebirds over alternative A because of the additional restrictions on aerial activities. This would be expected to benefit the health and productivity of both nesting and migratory shorebirds, which may help offset some of the adverse impacts experienced at the high-visitation areas.

Alternative C would not provide as much protection to migrating and staging shorebirds as alternative B because it does not include the additional restriction on pedestrians, boaters, and pets. However, alternative C would be nearly as effective at increasing the national seashore annual and five-year average productivity for shorebirds, reducing or eliminating the amount of decline, and likely meeting the recovery goals for the piping plover because it would provide the same level of control on the impacts of predation.

Cumulative Impacts. Actions outside the national seashore and within the surrounding region that would have an effect on shorebirds include the Cape Cod Master Plan – Water Quality/Restoration: Clean Water Act (section 208), the Herring River Restoration Plan, the *Monomoy National Wildlife Refuge Comprehensive Conservation Plan*, the town of Eastham’s enforcement of the ORV ban, and the Town of Orleans Habitat Conservation Plan. The water quality plan and Herring River restoration plan would benefit shorebirds by general improvements in quality and availability of habitat. The comprehensive conservation plan and ORV ban would also have beneficial effects to the shorebirds. The Habitat Conservation Plan would adversely affect a small number of shorebirds through incidental take as a result of opening additional beach to ORV use. Together, the impacts of

these other actions are likely to be beneficial, as the general habitat improvements would outweigh the incidental take. Alternative C would contribute seashore-wide beneficial impacts. In conjunction with the impacts of these other actions, the overall cumulative impacts would be beneficial, with alternative C contributing a beneficial increment due to increased productivity of nesting shorebirds through increased predator management.

Conclusion. Overall, alternative C would result in greater beneficial effects to national seashore shorebirds than alternative A because of additional protection due to restrictions on aerial activities and increased productivity due to lethal selective predator management (reducing predator impacts and the need for adult pairs to renest due to predation of eggs and chicks). Chicks that fledge earlier in the season will also have a longer time to prepare (i.e., gain fat reserves, build stronger flight muscles) for their migration in late summer which would increase survival of these first year birds. Alternative C would not provide as much overall protection of shorebirds as alternative B but would likely be as effective in increasing the national seashore annual and five-year average productivity and annual number of nesting pairs for shorebirds in most years, reduce or eliminate the amount of decline, and likely meet the recovery goals for the piping plover. These benefits would be substantial in the context of recovery goals and would maintain the integrity of the species and their habitat and increase protection to nesting shorebirds on a regional and local scale.

IMPACTS OF ALTERNATIVE D: MAXIMUM SHOREBIRD HABITAT PROTECTION

Under alternative D, all historic shorebird use areas (for breeding, feeding, and sheltering) and other priority habitats including entire sections of beaches (i.e., from bluff toe to waterline along approximately 27 miles) would be closed for all visitor use during the shorebird season (from March 15 to October 15) except for the six sections of life-guarded beach and associated parking lots.

Shorebirds would have few to no human, pet, ORV, or boat interactions (disturbance) and as a result would have substantially more access to breeding, feeding, and sheltering habitat, may have higher rates of successful first-nesting attempts, may have increases in the annual number of nesting pairs and productivity, and would exhibit much less displacement behavior. Closures to visitors, pets, ORVs, and boats would result in an increase of time spent by shorebirds feeding and sheltering prior to staging for migration. Closures would also result in less injury or death to shore birds from encounters with ORVs and pets. In addition, there would be reduced food left on beaches and visitors actively feeding wildlife (such as gulls, crows and Eastern Coyotes). Shorebirds would benefit from these actions; however, the benefits to nesting shorebirds may be offset and ultimately negated by losses due to predation. With little human presence to frighten them away, predators that forage on beach habitat will likely spend more time hunting, especially those that selectively prey on shorebird nests, and some predators may key in on nesting areas and protective structures. As a result, alternative D is not likely to change current trends in shorebird productivity because the continued levels of predation would likely result in maintaining current or possibly decreasing levels of annual and five-year average productivity, continuing shorebird decline within the national seashore, and not achieving recovery goals for piping plover and other special status species.

The shorebird staff would install predator exclosures around some piping plover nests and tern shelters as presently occurs under alternative A. Installation of predator exclosures around piping plover nests would provide protection for eggs but does not protect the precocial chicks as they leave the safety of the exclosure. Exclosures also have inherent risks that can contribute to nest failure such as adult piping plover mortality, nest abandonment, and predators keying in on

enclosures, plus terns and American oystercatchers do not tolerate enclosures, so this method would not provide any protection for these species.

Cumulative Impacts. Actions outside the national seashore and within the surrounding region that would have an effect on shorebirds include the Cape Cod Master Plan – Water Quality/Restoration: Clean Water Act (section 208), the Herring River Restoration Plan, the *Monomoy National Wildlife Refuge Comprehensive Conservation Plan*, the town of Eastham’s enforcement of the ORV ban, and the Town of Orleans Habitat Conservation Plan. The water quality plan and Herring River restoration plan would benefit shorebirds by general improvements in quality and availability of habitat. The comprehensive conservation plan and ORV ban would also have beneficial effects to the shorebirds. The Habitat Conservation Plan would adversely affect a small number of shorebirds through incidental take as a result of opening additional beach to ORV use. Together, the impacts of these other actions are likely to be beneficial, as the general habitat improvements would outweigh the incidental take. Actions outside the national seashore and within the surrounding region that would have an effect on shorebirds include dog regulations, ORV use, aerial recreation opportunities, the Cape Cod Master Plan – Water Quality / Restoration: Clean Water Act section 208, the Monomoy National Wildlife Refuge Comprehensive Conservation Plan, and the Town of Orleans Habitat Conservation Plan. The impact of alternative D in conjunction with the impacts of these other actions would result in both beneficial and adverse cumulative impacts on shorebirds over a long time period. Alternative D would contribute imperceptible adverse and beneficial increments to the overall cumulative impact because productivity of shorebirds, due to predation, is not anticipated to greatly vary from current conditions.

Conclusion. Overall, alternative D would reduce human disturbance and shorebird displacement, and protect shorebird habitat to the highest level, both within the national seashore and to regional populations, of any of the alternatives. This would result in substantial benefits to both nesting and migrating shorebirds through better body condition because shorebirds can feed, rest, and breed with relatively little disturbance. This would likely result in some increase in shorebird productivity throughout the general population. However, it is unlikely that the overall declining trend in productivity could be reversed through protection, alone. The primary driver of the downward trend in shorebird productivity and failure to meet recovery goals seen in recent years is the impacts of unnatural levels of predation, even with recreational restriction and habitat protection measures in place which reduce disturbance to nesting birds. Therefore, without effective controls on predation, it is unlikely that alternative D would substantially reverse the current decline in annual and five-year average productivity because the measures to increase protection of shorebirds would not reduce the losses to predation; indeed, there is some potential for predation to increase because of the lack of human presence to frighten predators away. Thus, while the benefits of alternative D would be substantial in the context of federal and NPS policies for protecting and managing shorebirds, the adverse impacts would also be substantial because we would not expect to meet or exceed recovery goals.

PREDATOR SPECIES AFFECTED ENVIRONMENT

Predators that use the habitats of the national seashore seasonally or year-around are diverse and include carnivorous and omnivorous species of mammals and birds (NPSpecies Database 2014). A few predators are relatively sedentary with small home ranges, but most are mobile and forage in moderate to large sized areas encompassing several habitats. Predator species discussed in this environmental assessment include those capable of capturing or feeding on shorebird eggs, chicks/fledglings, and adults; they also forage on a variety of additional vertebrate and invertebrate wildlife species, fruits and vegetation, pet food left outdoors, food scraps (including human garbage), and road kills. Additional information describing the range, diet, and habits of mammalian and avian predators in the national seashore, relative to shorebird predation, is summarized by species in the following subsections and detailed in appendix E.

Direct observation and tracking indicates that the predominant predators of nesting shorebirds in the national seashore are currently the American crow, Eastern coyote, and red fox. The USDA estimates that there is an estimated statewide population of 110,000 crows based on the North American Bird Breeding Survey (BBS) data (Rich et al. 2004). Crow populations in Massachusetts are believed to be increasing as data (1996–2007) from the BBS indicate an annual rate increase of 1.2% and data collected during the National Audubon Society (NAS) Christmas Bird Count (CBC) has also shown a general increasing trend since 1966 (see appendix E).

The US Department of Agriculture (2011a) suggested that the statewide population could range from nearly 2,000 coyotes to a high of nearly 4,000 coyotes if coyotes occupy 50% of the land area by using density estimates from Knowlton (1972) (appendix E). A coyote researcher of eastern Massachusetts estimates 200–250 coyotes are likely present on the Cape. The Massachusetts Division of Fish and Wildlife most recently estimated that the coyote population (summer) is approximately 10,000 coyotes statewide, based on reported coyote densities in rural and suburban areas and extrapolated over the state (L. Conlee, pers. comm. 2014). Population trends for Massachusetts provided by Monomoy National Wildlife Refuge (2004) indicate an increasing trend in the coyote population (see appendix E).

The elusive nature of the red fox makes it difficult to determine population estimates. The US Department of Agriculture (2011a) estimated that based on an assumption that red fox occupy 50% of the land area, and the density of red fox is 2.6 fox/mile², the statewide population could be estimated at 10,200 red fox (see appendix E).

Although no population estimates are available for these species within and near the national seashore, field observations and data collected through tracking (animal tracks up to shorebird nests, see appendix C) suggest that local predator populations are robust and growing. This has been attributed to increased availability of human-sources of food on beaches and shorelines. Food sources include food scraps left by visitors on the beaches; direct feeding by visitors of animals that beg, such as gulls; or fish remains left on the beach by fishermen. Human-sourced food supplements the natural food sources of these predators and subsidizes artificially high populations, higher than would likely be supported by natural food sources, alone. There are regulations in place directed at reducing and controlling refuse left by visitors on beaches and other areas of the park, which are published in the Superintendent's Compendium and enforced by park law enforcement staff. The park also conducts year-round refuse management education and techniques in an attempt to minimize human sources of food for predators and scavengers on beaches and shoreline habitats. However, even with regulations and enforcement procedures in place, the success of these measures

depends largely on visitor compliance which, to date, has been very low. There is no indication that this will change in the future; therefore, predator populations will likely remain at the current artificially high levels due to the availability of this supplemental food source.

Most predator species can be hunted or trapped within the state. The Massachusetts Department of Fish and Game (MDFG) established legal seasons and bag and possession limits by species. Hunting is permitted in some areas of the national seashore and follows the Massachusetts state hunting regulations, with a few exceptions outlined in the Superintendent's Compendium. The national seashore is in the Massachusetts State Wildlife Management Zone 12 (MDFG 2014).

PREDATOR SPECIES IMPACTS ASSESSMENT

For this analysis, potential effects on predators within the national seashore and adjacent Cape Cod region are based on impacts to predator populations, not individuals. As explained in chapter 1, the *NPS Management Policies 2006* allows for the removal of invasive species and individuals of a native species that pose a threat to other resources. Therefore, the focus of this analysis on predators is on the impacts that the selective removal of individuals may have on the population of that predator as a whole. Impacts are assessed based on the current description of predator species presented above and in appendixes D and E.

Resource-specific context for assessing alternative effects to predator species and individuals includes:

- Predators are evaluated using MDFG statewide and Wildlife Management Zone 12 population and life history information for each predator species identified in the existing environment discussion.
- Predator species are regulated under state hunting and trapping laws, meaning that their population size and harvest/take is monitored by MDFG statewide by Wildlife Management Zones.
- The viability of the species population from the selected removal of an individual predator.

IMPACTS OF ALTERNATIVE A: NO ACTION

Under alternative A, there would be no changes in current management actions with regard to predators on shorebirds. Therefore, alternative A would have no impacts on predators or predator populations.

Cumulative Impacts. Alternative A would have no impacts on predators; therefore, there are no cumulative impacts.

Conclusion. Alternative A would continue current management actions with regard to mammalian and avian predators that prey on shorebirds in the national seashore. There would be no changes; therefore, alternative A would have no impacts on predators or predator populations. Because alternative A would have no impacts, there would be no cumulative impacts.

IMPACTS OF ALTERNATIVE B: INCREASED PROTECTION AND FLEXIBLE MANAGEMENT PLUS ADDITIONAL MANAGEMENT OF PREDATOR IMPACTS (NPS PREFERRED ALTERNATIVE)

Under alternative B, management of predator impacts would include the current nonlethal methods and techniques described under alternative A with the addition of nonlethal electric fencing (mostly installed around portions of tern nesting colonies) to discourage larger mammals from entering nesting areas. Electric fencing would have no adverse impacts on predators beyond a mild shock that would surprise the animal and discourage it from entering the area. Where electric fencing is successful in deterring predation, it would deny individual predators a meal but with the availability

of other food sources in the foraging area, particularly human-sourced refuse, this would have no noticeable impact on predators or predator populations. There may be a slight benefit to predators that are deterred by electric fencing and other nonlethal controls if these individuals are discouraged from foraging in shorebird habitat and are thus removed from areas in which lethal controls may be implemented.

Alternative B includes selective lethal removal of individual avian and mammalian predators, targeting individual animals foraging on sections of beach with historically high shorebird activities that are experiencing low to very low productivity due to predation with evaluation by national seashore shorebird staff occurring on an annual basis using an adaptive management process.

The number of predators that would be selectively removed each season would vary based on monitoring by national seashore staff but is expected to be very small numbers that would not result in more than a negligible change in current predator populations. The National Park Service, for example, may lethally remove some American crows annually within the national seashore from an estimated statewide population of up to 110,000 individuals (appendix E). Eastern coyotes may also be lethally removed annually within the national seashore from an estimated statewide population of 5,000 to 10,000 individuals (appendix E). Red foxes may also be removed from an estimated statewide population of up to 10,000 individuals (appendix E). The number of predators that would be lethally removed cannot be predicted at this time but is expected to be in the range of one to a few individuals. It is likely that the largest number of predators would be removed in the first season or two and would then decline in subsequent seasons for a period of time until new individual predators moved in. Overall, the number of predators lethally removed is expected to be on the order of 10s (total number per year capped at 50 total for the first two years), which would not have any noticeable adverse impacts on predator populations.

Cumulative Impacts. Actions outside the national seashore and within the surrounding region that would have an effect on predators include the *Monomoy National Wildlife Refuge Comprehensive Conservation Plan*, which would continue to allow for, and increase, lethal predator management. The refuge predator management program would have a negligible adverse effect on the predator species population. For example, in the past 10 years, the refuge has removed on average 14 coyotes per year (see appendix E); when compared to a state-wide estimated population of between 5,000 and 10,000, this represents approximately .003% of the state population. The impact of alternative B, in conjunction with the impacts of these other actions, would result in slight adverse cumulative impacts on predators over a long time period.

Conclusion. Alternative B would result in a slight reduction in the number of predators in the park due to lethal removal of individuals that are selectively preying on shorebird eggs and chicks and would contribute a slight adverse increment to cumulative impacts. Eastern coyotes and/or red fox and other mammals may be adversely affected by electric fencing installed to protect plover and tern nests that would potentially provide them with less forage; avoidance of these nesting areas may be slightly beneficial to these predators by making them less susceptible to lethal management. These adverse impacts would be considered negligible because predator populations in the national seashore and surrounding Cape Cod region would be expected to remain stable and viable.

IMPACTS OF ALTERNATIVE C: CURRENT MANAGEMENT ACTIONS PLUS ADDITIONAL MANAGEMENT OF PREDATOR IMPACTS

Under alternative C, the actions to manage predator impacts on shorebirds would be the same selective lethal removal of individuals plus nonlethal methods that were described under alternative

B. Therefore, impacts to predator populations would be the same as those described under alternative B.

Cumulative Impacts. Cumulative impacts under alternative C would be the same as described under alternative B.

Conclusion. Overall, alternative C would result in the same impacts to predators as alternative B and would be considered negligible.

IMPACTS OF ALTERNATIVE D: MAXIMUM SHOREBIRD PROTECTION WITHOUT ADDITIONAL MANAGEMENT OF PREDATOR IMPACTS

Under alternative D, all historic shorebird use areas and other priority habitats including entire sections of beaches (i.e., from bluff toe to waterline) would be closed for all use during the shorebird season (from March 15 to October 15) except for the six sections of life-guarded beaches. Management of predator impacts on shorebirds would be through the same nonlethal methods described under alternative A, plus the use of piping plover exclosures and tern shelters and electric fencing as proposed under alternative B.

Closure of beaches to all use may potentially decrease the number of predators because of the reduction in human-provided food sources that currently subsidize predators. If predators are habituated to daily foraging for food left on beaches by visitors, some may abandon this behavior and move to areas where garbage (i.e., food scraps) is still available. There may be some decrease in predator numbers on the beach but they may simply shift their range to find new human sources of food and overall population trends remain stable on Cape Cod. It would depend on whether garbage on the beach outweighs garbage available elsewhere on the Cape.

Predators that continue to forage in beach habitats may potentially have less disturbance because there would be few or no people and pets around. This may help increase their survival because they can forage longer with no interference from human uses. But this reduced disturbance could be offset to some degree by the use of nonlethal methods of protecting shorebird nests such as exclosures and electric fencing that would prevent most predator access to eggs and chicks as a food source. This may reduce their available food or they may just shift to foraging on unprotected nests or look for other naturally sourced food items plus whatever human refuse is still available.

Alternative D may have slight adverse impacts on predator populations as a result of decreased availability of human-provided food sources; however, it is unlikely there would be any noticeable change in predator populations. Predators would shift their foraging areas and result in a corresponding shift in distribution of predators as they seek other alternative food sources or widen their search for natural food sources. In the case of predators that continue to forage on beaches, the closures and lack of humans and pets would benefit these predators because they would experience less disturbance while foraging and would be able to forage longer to compensate for reduced access to shorebird nests and reduced refuse on the beaches.

Cumulative Impacts. Actions outside the national seashore and within the surrounding region that would have an effect on predators include the *Monomoy National Wildlife Refuge Comprehensive Conservation Plan*, which would continue to allow for and increase lethal predator management. The refuge predator management program would have a negligible adverse effect on the predator species population. The incremental impacts of alternative B, in conjunction with the impacts of the other

actions, would result in slight adverse cumulative impacts on predators over a long time period. The impact of alternative D, in conjunction with the impacts of these other actions, would result in both beneficial and adverse cumulative impacts on predators over a long time period. Alternative D would contribute a slight adverse increment because some predators would lose an available food source and would also contribute a slight beneficial increment because predators could continue to forage on beach habitat and have less disturbance; however, it is unlikely that these impacts would result in any noticeable change in predator populations.

Conclusion. Alternative D would result in both beneficial and adverse effects to individual predators and populations. Alternative D would result in slight beneficial effects to predators because American crows, Eastern coyotes, and red fox, for example, would have less disturbance by human presence. Alternative D would also result in slight adverse impacts because some predators would lose the opportunity to take advantage of human-provided food scraps left on beaches. Cumulative impacts on predators related to beach closures would be both adverse and beneficial due to loss of food sources but with decreased human disturbance. It is unlikely that any of these impacts would result in a noticeable change in the overall populations of predator species, which are expected to remain stable and viable.

PUBLIC USE AND VISITOR EXPERIENCE AFFECTED ENVIRONMENT

An estimated six million tourists visit Cape Cod each year with nearly two-thirds of all visitors arriving in the summer and early fall. On the Cape, there are approximately 560 miles of undeveloped coastline with over 100 named beaches, including the national seashore (<http://www.capecodchamber.org/beaches>; <http://www.oncape.com/beaches>).

The national seashore and surrounding communities provide exceptional leisure and active recreational opportunities at Cape Cod in terms of both variety and quality. From 2008 to 2014, the national seashore received from between 4.3 to 4.7 million visitors annually, including many repeat visits by full-time and seasonal residents of the Cape and nearby areas. Table 3 depicts the seasonal nature of these visits and the increased visitation during the shorebird nesting through migration seasons. Peak visitation occurs during July and August.

TABLE 3. NATIONAL SEASHORE VISITATION FIGURES (MONTHLY NUMBER OF VISITS) 2008–2014

	Year						
	2014	2013	2012	2011	2010	2009	2008
January	110,260	122,736	124,095	104,608	108,585	95,271	160,536
February	100,914	135,646	131,024	100,218	115,351	142,650	123,480
March	154,928	184,199	230,858	168,271	172,554	176,443	154,176
April	231,187	238,561	262,381	257,933	273,613	282,861	303,361
May	346,841	345,486	329,107	323,490	319,446	347,258	359,078
June	567,721	466,484	499,236	484,766	541,268	444,506	432,796
July	837,591	832,670	881,328	865,639	873,731	810,164	872,651
August	948,247	917,976	852,951	1,029,194	1,029,421	868,289	946,625
September	504,970	583,050	493,044	453,354	567,099	540,604	530,581
October	303,705	381,849	365,664	394,611	347,087	332,008	399,733
November	196,787	197,304	166,124	171,559	205,181	182,395	190,245
December	133,511	125,644	135,026	130,496	129,918	118,785	125,121
TOTAL:	4,456,299	4,531,605	4,470,838	4,484,319	4,683,254	4,341,234	4,673,783

Source: [Irma.nps.gov](http://irma.nps.gov)

Most visitors to the national seashore live in the northeast; however, all 50 states, the District of Columbia, and Canada were represented in a visitor survey completed in 1994 (Manning 1994). Survey respondents engaged in more than 20 types of activities during their visits to the national seashore, the primary activities included: (1) viewing scenery, (2) sunbathing, (3) swimming in the ocean, (4) beachcombing, (5) hiking, and (6) driving scenic roads. According to the survey, most visitors were highly supportive of protecting the natural and historic resources of the national

seashore, most approved of the current balance between public use and resource protection, and most felt that natural and historic resources were being well preserved. Additionally, most visitors would support tighter controls on recreation use if necessary for resource protection.

Most visitors tend to be frequent, repeat visitors, and more than 85% of the local residents responding to the survey reported frequent visits to the national seashore. The pattern of use is mostly day use however evening programs have been popular and attendance requests often exceed the programs available. Frequent visitors generally have a consistent pattern of use, usually engaging in particular activities at favorite sites in the national seashore during the day and leaving in the afternoon or evening to overnight accommodations locally or in the nearby region. The most popular destinations in the Outer Cape region were beaches managed by the National Park Service, visitor centers, headquarters, the Marconi Station site, lighthouses, Nauset Beach, Fort Hill and trails, and the Atlantic white cedar swamp. According to the survey, most visitors did not consider the national seashore their primary destination on Cape Cod (GMP/EIS 1998).

Public use is highly seasonal, with 50% of the annual visitation occurring in June, July, and August and as little as 10% in the November to March period. Visitation during the spring and fall shoulder seasons is becoming more popular.

On-season summer visitation from about Memorial Day to Labor Day consists of a broad mix of regional, national, and some international visitors attracted by outdoor activities, principally swimming, sunbathing, and beachcombing. More passive outdoor activities, such as nature study, photography, picnicking, and camping at private or state campgrounds or on the beach are also popular. More than half of all visitors participate in some road and trail related activities including driving on scenic roads, hiking, and bicycling. The wider configuration of the Outer Beach and the presence of sportfish make summer the peak season for surf-fishing and ORV beach driving (GMP/EIS 1998).

Winter visitation (November through March) consists primarily of local and regional visitors. Even with frequently harsh weather, winter visitors continue to be attracted to the beaches to walk, beachcomb, and watch nor'easter storms. Most visitors favor scenic driving and hiking but when conditions permit cross-country skiing and bicycling are popular.

Shoulder seasons (April to May and September to October) are the most popular periods for many local and regional residents because of the combination of moderate weather and smaller crowds, although weekend attendance can sometimes match peak summer visitation levels. Visitors continue to favor road and trail activities such as scenic driving, hiking, and bicycling.

Interest in nature study and visiting park historic buildings has increased and more tour bus and educational groups contribute to an additional demand for services at the visitor centers. In warmer weather camping is popular at nearby private and state campgrounds. Hunting for small game, wild turkey, deer, and waterfowl attracts visitors to some areas of the national seashore where allowed (GMP/EIS 1998) under the regulations established and enforced by the Massachusetts Department of Fish and Game.

VISITOR ACCESS AND FACILITIES

There are two major highway routes to the Cape: I-495 across the Bourne Bridge and MA 3, across the Sagamore Bridge. US Route 6 (Mid-Cape Highway) is the main road for traversing the Cape and the primary access route for the national seashore. It has been estimated that more than 95% of

visitors arrived by private car (GMP/EIS 1998). Although no recent surveys have been conducted, the Cape Cod Commission 2009 stated that vehicle use along US Route 6 remained relatively constant from 1998 to 2008 (Cape Cod Regional Transportation Plan for 2012–2035).

Roads and trails provide public access to national seashore resources and access largely determines the range of public activities and experiences; there is increasing demand for access to ocean beaches, kettle ponds, historic sites, and other public use attractions, which have limited on-site parking (GMP/EIS 1998). Most public use opportunities within the national seashore are easily accessible. Parking lots are close to attractions and most hikes are short and easy. Most visitors recreate together at the developed sites regardless of their level of ability, available time, or desire for challenge. In the summer, destinations are often crowded and sometimes experience overuse. At times, visitation meets or exceeds capacity at existing public use facilities particularly at parking lots of certain beaches, visitor centers, trails, and scenic viewing areas (GMP/EIS 1998).

Access to environmentally sensitive areas such as shoreline cliffs, kettle ponds, and dunes is often limited by NPS management efforts to protect these resources and concern for public safety. The presence of town-owned and privately owned property in the national seashore also leads to access restrictions. Sand roads are a traditional means of access linking many features in the national seashore, yet ownership and access rights along these corridors are often in dispute and the mixture of ownerships can confuse visitors. In developed areas in the national seashore and in town commercial areas access is limited by the capacity of local access roads and the availability of on-site parking (GMP/EIS 1998).

Parking lots for the six life-guarded beaches offer a total of 2,323 parking spaces. Other general-use parking lots are available throughout the national seashore for access to walking trails, bike trails, and natural areas. The parking lots are open 6:00 a.m. to midnight, daily, year-round and their capacity near the life-guarded beaches is provided in table 4. Additionally, the Cape has approximately 40 public beaches outside the national seashore, many of which offer parking (<http://www.visit-massachusetts.com/capecod/beaches/>).

TABLE 4. PARKING LOT CAPACITY NEAR SIX DESIGNATED SWIM BEACHES

Life-Guarded Beach	Vehicle Capacity
Coast Guard, Eastham	44
Little Creek (satellite parking for Coast Guard)	360
Nauset Light, Eastham	157
Marconi Beach, Wellfleet	528
Head of the Meadow, Truro	282
Herring Cove (North and South lots), Provincetown	590
Race Point, Provincetown	362
Total	2,323

RECREATION OPPORTUNITIES

The national seashore provides a diverse range of recreational opportunities including swimming, boating, kayaking, surfing, ORV use, biking, bird and other wildlife viewing, fishing, self-contained vehicle camping, hiking, hunting, nature walks, horseback riding, and stargazing, many of which occur on the beaches.

Swimming

There are six designated swim beaches on the national seashore: (1) Coast Guard Beach (Eastham), (2) Nauset Light Beach, (3) Marconi Beach (Wellfleet), (4) Head of the Meadow Beach (Truro), (5) Race Point Beach (Provincetown); and (6) Herring Cove Beach (Provincetown); they are life-guarded from late June through the last week of August. The number of visits to these swim beaches from 2008 to 2014, inclusive is presented in table 5.

TABLE 5. VISITATION FIGURES AT LIFE-GUARDED BEACHES, 2008–2014

Beach	Year						
	2014	2013	2012	2011	2010	2009	2008
Head of the Meadow	265,412	244,941	225,800	186,160	240,668	245,784	211,554
Coast Guard	445,059	342,654	308,802	446,532	534,519	430,581	433,683
Marconi	286,608	240,954	267,198	270,717	289,416	256,638	257,313
Nauset Light	593,349	614,100	623,973	589,935	547,596	568,032	690,594
Race Point	432,420	488,337	339,114	363,392	465,964	347,908	323,884
Herring Cove	796,894	848,630	876,020	853,295	816,022	650,022	815,352
Total	2,819,742	2,779,616	2,640,907	2,710,031	2,894,185	2,498,965	2,732,380

Derived from NPS 2010c and updates
Total annual number of visits at Cape Cod National Seashore

Boating and Boat Landing

With a large summer population and over 550 miles (885 km) of shoreline, boating around Cape Cod is a popular pastime. Boating conditions on the Cape range from the sheltered bays and the slightly more exposed areas of Cape Cod Bay and Nantucket Sound to the extremely exposed Atlantic Ocean. In recent years, the more remote beaches of the national seashore have become popular destinations for boaters creating natural resource impact concerns. On any given summer day it is not uncommon to see motor boats, kayaks, and canoes along some sections of shoreline where the

passengers fish, swim, watch wildlife, barbecue, picnic, play sports, and sunbathe. Personal watercraft (e.g., Jet Skis, SeaDoos, etc.) are prohibited in the national seashore.

Boats may be trailered to and launched from any open section of the ORV corridor. In some areas the national seashore staff temporarily restricts visitors arriving by boat to access the shoreline used for shorebird nesting, migrating, and staging areas to reduce human disturbance. The same access restrictions apply to private individuals and commercial service providers.

Surfing and Windsurfing

Surfing and windsurfing are permitted in waters outside of life-guarded beaches when lifeguards are not on duty (before 9:15 a.m. and after 5:15 p.m.). Area restrictions and beach access restrictions apply to both individual surfboarders and windsurfers and those who are clients of commercial services providers.

Wildlife Watching

In 2011, about 1.8 million US residents (16 years and older) participated in wildlife viewing activities in Massachusetts (USFWS 2011b). The Cape Cod landscape feature known as the “outstretched arm” makes it the first landing point on the north-south Atlantic Flyway for migrating birds and is the destination for some of the finest birding on the East Coast.

Besides bird-watching at the national seashore, visitors can also observe several species of butterflies and dragonflies, reptiles and amphibians, and marine mammals (e.g., seals, whales, etc.). From late spring through early fall harbor and gray seals haul-out have occurred on Coast Guard Beach in Eastham, Jeremy Point, Wellfleet, High Head, Head of the Meadow in Truro, and the Monomoy shoals in Chatham. The seal haul-outs attract visitors who participate in viewing, photography, and managed interaction (from a distance) with the large ocean mammals.¹

Off-Road Vehicle Access and Use

Off-road vehicle access is permitted at the national seashore along a designated beach corridor in Provincetown and Truro. ORV access is guided by rules developed through negotiated rule making (1998 Neg Regs) and the 2007 EA Options for Managing ORV Access (NPS 2007a) and its associated Finding of No Significant Impact (FONSI) (NPS 2007b). The national seashore works to minimize impacts of ORV use (including essential NPS vehicles) on beach habitat and wildlife, including shorebirds. ORVs are used to access the beach to fish, picnic, swim, view wildlife and scenery, and to gain access to portions of the outer beach. Permitted ORVs may be owned by private individuals or authorized commercial service providers and the same access restrictions apply to both groups.

The ORV-designated beach corridor from Provincetown to Truro (8.5 miles) is managed by the national seashore to accommodate these uses. The corridor is open from April 15 to November 15 and accessible 24 hours per day when conditions allow. Sections of beaches along the ORV corridor are closed to vehicles when they become too narrow to drive on. Some of the areas identified as

¹ Hauling-out is the behavior associated with pinnipeds (true seals, sea lions, fur seals and walruses), of temporarily leaving the water for sites on land or ice. Hauling-out is necessary in seals for mating and giving birth. Other benefits of hauling-out may include predator avoidance, thermal regulation, social activity, parasite reduction and rest (Wikipedia).

vulnerable to erosion, exposure to storm surges, and sea level rise due to climate change by the 2010 working group include the ORV corridor (see figure 5).

In the off-season, as outlined in the 1998 Neg Regs, a limited access pass is available for individuals with an annual ORV pass “for the purposes of (1) getting to the town shellfish beds at Hatches Harbor, (2) recovering personal property of flotsam and jetsam from the beach, (3) caretaker functions at the dune cottages or fishing.”

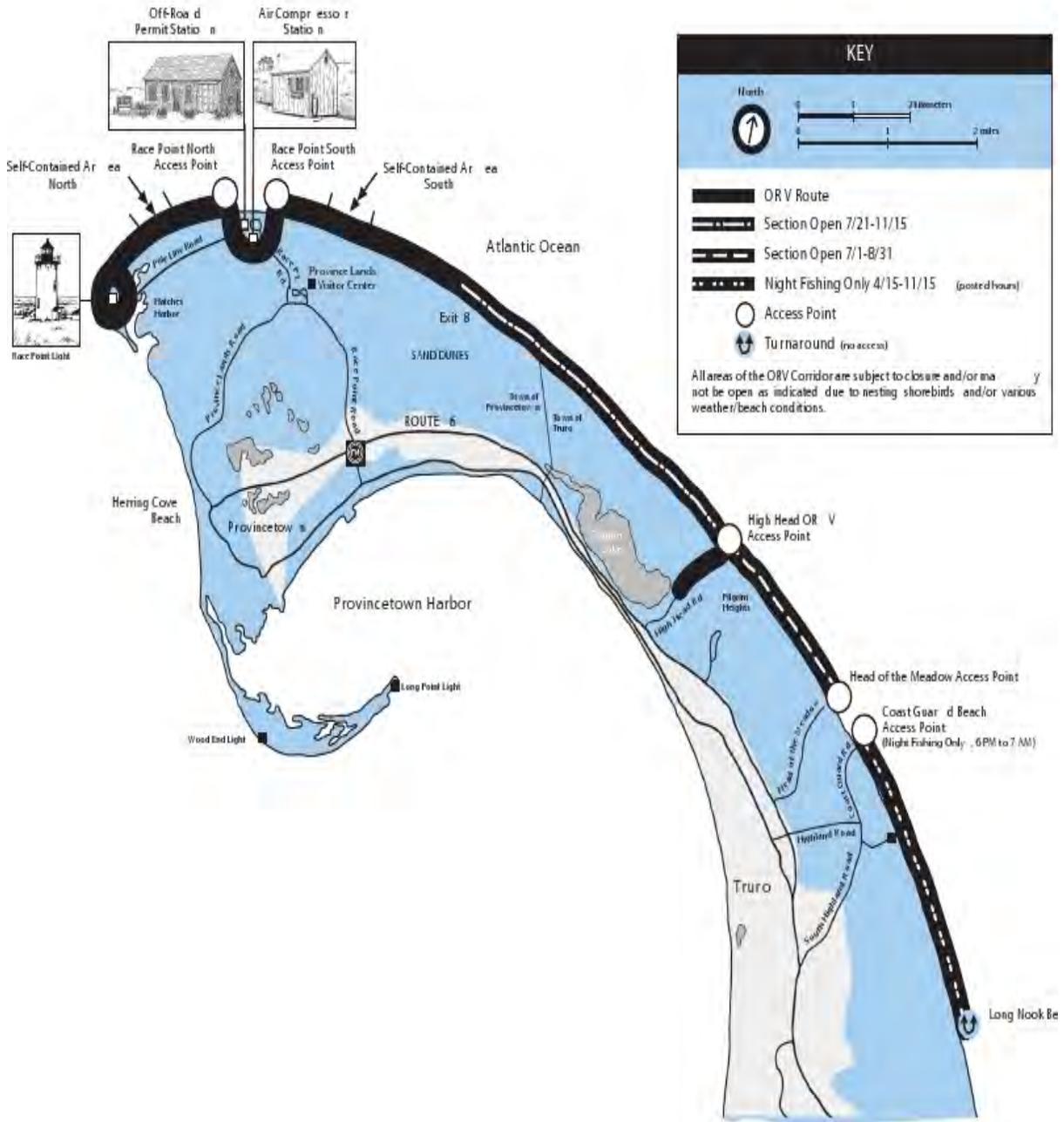
Overnight camping is allowed in designated areas of the ORV corridor on Race Point Beach. For overnight camping, users must have a SCV, either a motor home or truck with an attached camper shell, and permanently mounted separate holding tanks for black and gray water storage. Overnight camping is by permit only and limited to a maximum of 100 permitted vehicles on any given night, subject to variable beach conditions and temporary beach closures due to tides, nesting birds, or surface configuration (beaches are too narrow).

The ORV corridor is generally open to vehicles during the egg-laying and incubating phase of the shorebird nesting season in areas where the beach is wide enough for safe driving and there is an adequate protective buffer between the incubating shorebirds and vehicles. As chicks hatch, sections of the ORV corridor are closed to protect unfledged shorebird chicks. In addition, sections of the corridor may be temporarily closed or rerouted to protect staging and migrating terns, red knots, and other shorebirds in mixed flocks. The ORV access routes and seasonal restrictions are shown in figure 6. Figures 7a and 7b provide an overview of how much of the ORV corridor was available (the maximum amount of corridor miles legislated by the 1998 Neg Regs for ORV use) and open (the actual amount of ORV corridor miles that was open from April through September). The remaining ORV corridors were closed to vehicles due to resource or safety considerations during the 2013 and 2014 shorebird nesting season and into the fall migration season, respectively.

Pole Line Road and Inner Dune Route

Pole Line Road is only open to provide access to the Race Point Light Station and Hatches Harbor when the primary access route is closed. The 1998 Neg Regs states Pole Line Road would only be open when the superintendent opens the route due to high tides, beach erosion, shorebird closure, or other circumstances that will, as a result, warrant public use of this accessway. The Race Point Light Station is operated by the Cape Cod chapter of the American Lighthouse Foundation and is at the end of Pole Line Road. The US Coast Guard owns the light of the Race Point Light Station, transportation to the lighthouse is by ORV, and public visitation is allowed from Memorial Day through Columbus Day annually. Guests with reservations may stay overnight in the Lighthouse Keeper’s House or the Whistle House. The Pole Line Road is open to pedestrians. ORV access along Pole Line Road is managed under the 1998 Neg Regs.

The Inner Dune Route provides access to permitted owners and users of the dune shacks and is closed to the general public. The national seashore permits dune tours, including along the Inner Dune Route, through the commercial use authorization (CUA) program. Art’s Dune Tours is the only authorized CUA holder at this time and follows prescribed recourse protection guidelines.



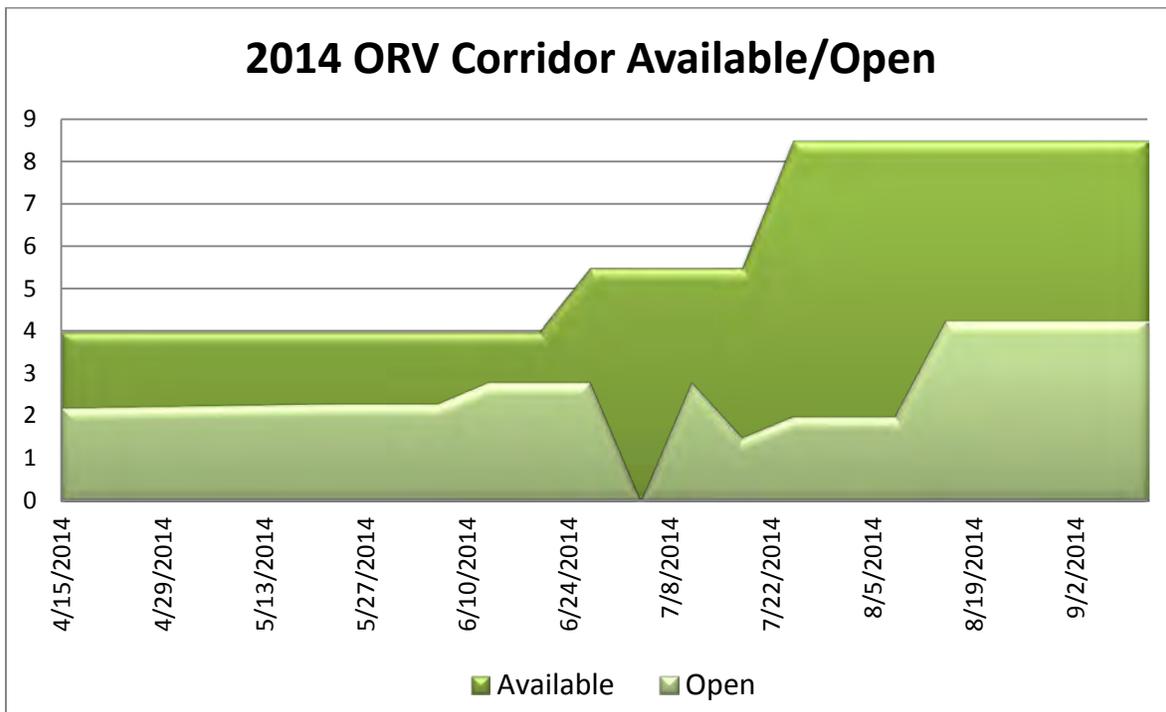
Source: 2015 Off-Road Vehicle Informational and Regulations brochure

FIGURE 6. ORV ROUTES AND SEASONAL RESTRICTIONS ON CAPE COD NATIONAL SEASHORE



Source: 2013 Cape Cod National Seashore Off-Road Vehicle Activity Report

FIGURE 7A. ORV CORRIDOR OPEN AND AVAILABLE MILES DURING THE 2013 NESTING SEASON AND INTO FALL MIGRATION



Source: 2014 Cape Cod National Seashore Off-Road Vehicle Activity Report

FIGURE 7B. ORV CORRIDOR OPEN AND AVAILABLE MILES DURING THE 2014 NESTING SEASON AND INTO FALL MIGRATION

Pets

Pets are allowed in the national seashore subject to certain restrictions. Pets must be on a leash of 6-foot (1.8-meter) or shorter in length at all times (36 CFR 2.15) to prevent them from disturbing or harming people and other pets, harassing wildlife, and for their own safety. Seasonal pet restrictions and the enforcement of leash laws at the national seashore minimizes disturbance to nesting and staging shorebirds and other wildlife. Specific details of where pets are allowed in the seashore are outlined in the national seashore Superintendent's Compendium.

There appears to be some increase in the number of pets in the national seashore, thought to be the result of fairly recent bans on dogs implemented by many of the towns during the summer. Pet restrictions at town parks and other natural areas are becoming stricter on the Cape with fewer areas open to dogs, especially in the summer months. Brewster, Chatham, Eastham, Orleans, and Wellfleet all have seasonal no-dog restrictions, some beginning as early as April 1 and some extending through Columbus Day. Provincetown allows leashed pets in specific areas, Truro allows dogs after 6:00 p.m. and before 9:00 a.m. With more Cape towns and nongovernment agencies restricting or banning dogs on beaches and parks, there are fewer places for people to walk or run their pets. Because the national seashore still allows pets, some people are now bringing their dogs to the national seashore, instead.

Aerial Recreational Activities

Aerial recreational activities such as hand-held kites, kiteboarding (also called kitesurfing), paragliding and hang gliding, and remote control planes are conducted at the national seashore. Kiteboarding has increased in popularity over the years and involves using large kites (6 to 65 feet or more [1.8 to 19.8 meters or more]) to propel small surfboards with human riders across the water and into the air.

Paragliders and hang gliders both need to launch from tall cliffs to become airborne and carry human riders. Hang gliders have a stiff aluminum frame and can travel 18 to 60 mph whereas the paraglider is essentially a large "parachute" wing with no frame and can travel 15 to 25 mph.

The current restrictions regarding aerial recreational activities at the national seashore include:

- Hand-held kites and any other airborne devices (e.g., remote/radio control planes, para/hang gliding) are prohibited above and within 656 feet (200 meters) of posted shorebird use areas or life-guarded beaches.
- Kiteboarding is prohibited from March 15 through October 15 on all open waters on ocean and bayside within the national seashore (2014 National Seashore Compendium). One exception is a small section of beach owned by the Town of Wellfleet at Duck Harbor (if >656 feet (200 meters) away of posted shorebird use areas) where kiteboarders can launch their kites and take a direct route of 0.25 mile (400 meters) offshore to outside the national seashore boundary.

Influence of Climate Change on Visitor Use

National seashore staff participated in an expert workgroup to identify areas on Cape Cod, including the national seashore, which are vulnerable to the anticipated impacts of climate change. Figure 5 depicts vulnerable areas.

In general, climate change, which is anticipated to affect temperature, precipitation, frequency and intensity of extreme events (storms and drought), and accelerated sea level rise, can accelerate erosional processes causing beaches to erode and narrow. As beaches narrow, the lack of dry beach, especially at high tide, forces beachgoers and the highly mobile plover broods to come in close contact with one another, increasing the frequency and probability of human disturbance and the need for additional restrictions on visitors to prevent disturbance. The narrowing of beaches would also result in closures of sections of the ORV corridor. Seashore staff have observed beach narrowing at Coast Guard, Marconi, and Race Point Beaches, and more frequent closures of the ORV due to loss of beach in recent years. The narrowing of beaches and resulting closures would have negative impacts on visitor experience.

VISITOR USE AND EXPERIENCE IMPACTS ASSESSMENT

For the analysis, potential effects of the shorebird management alternatives on visitors within the national seashore and adjacent Cape Cod region are assessed based on the current description of visitor use experience presented above. Resource-specific context for assessing impacts of alternatives to visitor use and experience includes:

- current and future generations of visitors may continue to experience and enjoy the recreational, scenic, solitude, and wildness values of the national seashore
- the national seashore provides appropriate recreational uses including, swimming, boating, ORV use, SCV camping, fishing, pedestrian access, and aerial activities

IMPACTS OF ALTERNATIVE A: NO ACTION

Under alternative A, there would be no changes in existing restrictions and closures on facilities, visitor access, roads, and trails for the protection of shorebirds. Visitors would continue to modify plans and specific locations to accommodate temporary closures and detours and additional restrictions during peak visitation months. No changes in visitor use and experience would be expected under alternative A; therefore, alternative A would have no impacts on visitor use and experience.

Cumulative Impacts. Alternative A would result in no impacts on visitor use and experience, and therefore, there would be no cumulative impacts on visitor use and experience.

Conclusion. Alternative A would have no impacts, and no cumulative impacts, on visitor use and experience because there would be no change in existing restrictions and closures on visitor uses for the protection of shorebirds. Visitors would continue to enjoy the same level of access, beach recreational activities, and ability to experience the natural and scenic qualities of the national seashore as they do now.

IMPACTS OF ALTERNATIVE B: INCREASED PROTECTION AND FLEXIBLE MANAGEMENT PLUS ADDITIONAL MANAGEMENT OF PREDATOR IMPACTS (NPS PREFERRED ALTERNATIVE)

Alternative B provides a balance between maintaining recreational opportunities for visitors and increasing these opportunities in some areas while maintaining protection for shorebirds and expanding protection in other areas. Some high visitor use areas would be flexibly managed (under-protected) for a limited number of piping plovers to provide consistent visitor use and access as possible. Parking lots in the national seashore would remain open regardless of shorebird activity allowing for access to popular areas and beaches. Area closures and activity restrictions would be expanded to more areas in the park outside the high visitor use areas and lengthened by two weeks in most cases to increase protection for staging and migratory shorebirds. In addition, with lethal selective predator removal, first nesting attempts may be more successful due to reduced predation on eggs and chicks, leading to fewer re-nesting attempts, which would shorten the nesting season and allow some vehicle and visitor restrictions to be lifted sooner.

Visitors that come to use the life-guarded beaches would see either no change or would see benefits because the beaches and associated parking lots would be open on a reliable schedule, there may be additional beach areas open due to flexible management and possible lifting of beach restrictions earlier in the season due to more successful first nesting attempts by special status shorebird species.

ORV users would also see either no change or some benefits under alternative B. Vehicles would be allowed access in the designated ORV corridor during the egg-laying and incubating phase of the nesting season, provided that beach configuration allows for travel. Compared to existing conditions, more areas of unoccupied suitable shorebird habitat that are wide enough to protect shorebirds and accommodate ORVs could remain open for driving lanes under alternative B. Management of Pole Line Road (if opened) and Inner Dune Route could provide ORV and/or special use access unless piping plover nests are established on or in proximity to the road. Flexible management could be used on these two access roads to allow ORV use, if needed. Vehicle restrictions may also be shortened due to more successful first nesting attempts by special status shorebird species. Drive-through areas may be established past nesting shorebirds on narrow sections of beach when possible to allow continued ORV use although more restrictive than under current management. There would be no change in SCV areas.

Visitors that are likely to experience adverse impacts under alternative B are those who tend to be more specific in their use of the national seashore such as boaters who plan trips that include landing on seashore beaches; visitors who plan trips specifically for viewing wildlife and may spend the majority of their time hiking for this purpose or viewing from a greater distance; and visitors who use the seashore for aerial activities, particularly kiteboarding. These impacts would be greatest during the summer months and less during the off-peak seasons. For these users, the restrictions and closures under alternative B would mean they would have to change their plans; i.e., go to another location on the Cape where the activity is not restricted or banned; visit the national seashore at a different time of year when there are few or no restrictions in place; or engage in their activity to the extent possible within the limits imposed by the management actions. Although, for boaters, restrictions would be lessened on a portion of the tip of Coast Guard Spit, Eastham, which would remain open for boat landing at all times unless future information indicates total closure warranted or to protect nesting piping plovers.

Boaters may potentially have fewer restrictions on beach landing during the nesting season due to less shorebird protection on a section of beach, but greater restrictions in areas used by staging and migratory shorebirds during mid-summer and fall. Boat landing restrictions in areas of staging and

migratory shorebirds would be more restrictive under alternative B for boaters than the current restrictions. As under alternative A, boat closures would be established on some beaches and tidal flats for roseate terns, red knots, and other staging and migrating shorebirds as the flocks begin to arrive. These sections could be closed to boat access from July 15 through October 15. In addition, sections of bay, ocean beaches, and tidal creeks may be temporarily closed to boats/kayaks between July 15 through October 15 to protect concentrations of staging and migratory shorebirds using the beach habitat. Most boat closures would be temporary, boaters would need to monitor closures when planning their outings and some boaters may not be able to visit a specific location at specific times.

All historically important staging and feeding areas would be closed for migratory birds restricting recreational beach use (pedestrian, boaters, and pets) in these areas during the migratory season. Restrictions related to pets would be greater and for longer periods of time under alternative B than under current management. Visitors may be able to access certain areas but only without their pets, which may decrease visitor enjoyment for those who like to walk their dogs along the beach at certain times of the spring/summer. Sections of beach would re-open to pets when the post-breeding adult shorebirds and fledged chicks have migrated. There would be no change at beaches that currently allow pets and do not have breeding or concentrations of migrating or staging shorebirds.

Kiteboarding, paragliding, and hang gliding would be prohibited from March 15 to October 15. Some visitors would not be able to enjoy these aerial activities during this time period within the national seashore. These impacts would be greatest during the summer months and less during the shoulder seasons. For these users, the restrictions and closures under alternative B would mean they would have to change their plans; i.e., go to another location on the Cape where the activity is not restricted or banned; visit the national seashore at a different time of year when there are few or no restrictions in place. Other visitors may appreciate their national seashore experience more without these visual and auditory intrusions caused by these aerial recreational activities.

Cumulative Impacts. Actions outside the national seashore and within the surrounding region that would also have an effect on visitor use and experience on Cape Cod include ORV ban in Eastham, ORV use in Orleans, and additional recreational restrictions at the Monomoy National Wildlife Refuge. The ORV ban and additional restrictions at Monomoy would have an adverse impact on recreationalists, while the town of Orleans would allow consistent ORV access resulting in a beneficial effect. The impact of alternative B in conjunction with the impacts of these actions would result in both beneficial and adverse cumulative impacts on visitors and would occur over a long time period. Alternative B would contribute negligible adverse and beneficial increments to the overall cumulative impact due to increased and decreased restrictions in different areas.

Conclusion. Under alternative B, there would be adverse impacts on visitor use and experience caused by the increased restrictions, closures, and activity bans in some areas during certain times of the year. There would also be beneficial effects due to potential shortening of restrictions in the late summer months and reducing restrictions on some uses in specific areas, especially the high visitation areas. Visitors that come to use the life-guarded beaches would see either no change or would see benefits because the beaches and associated parking lots would be open on a reliable schedule. There may be additional beach area open due to possible lifting of beach restrictions earlier in the season. Alternative B would have adverse effects on visitors who tend to be more specific in their use of the national seashore such as boaters, dog walkers, wildlife watchers, and aerial recreationalists. Alternative B would contribute imperceptible beneficial and adverse increments to the overall cumulative impact. In the context of visitor enjoyment of the national seashore and providing appropriate recreational uses, the impacts of alternative B would be considered minor because while some visitors will notice more restrictions and other visitors may

benefit from new or reduced restrictions, overall, the majority of visitors would continue to use and experience the national seashore and have a variety of recreational opportunities.

IMPACTS OF ALTERNATIVE C: CURRENT MANAGEMENT ACTIONS PLUS ADDITIONAL MANAGEMENT OF PREDATORS

Under alternative C, visitor access, life-guarded beaches, boat landings, ORV uses and access, and pets would remain the same as under alternative A. Differences would occur in wildlife watching and timing of restrictions. By using selective lethal predator management, first nesting attempts may be more successful due to reduced predation on eggs and chicks resulting in a shorter shorebird nesting/fledging season. Restrictions placed on ORV and other visitor uses for breeding and nesting shorebirds could be lifted earlier in the summer season.

Visitors who enjoy bird-watching would see an increase in shorebird numbers but increased enforcement of some areas may limit access at times during the shorebird breeding, nesting, staging, and migration periods.

Kiteboarding, paragliding, and hang gliding would be seasonally prohibited from March 15 to October 15. Some visitors would not be able to enjoy these aerial activities during this time period, while other visitors may enjoy their national seashore experience without these visual and auditory intrusions.

Cumulative Impacts. Actions outside the national seashore and within the surrounding region that would also have an effect on visitor use and experiences include ORV ban in Eastham, ORV use in Orleans, and additional recreational restrictions at Monomoy National Wildlife Refuge. The ORV ban and additional restrictions at Monomoy would have an adverse impact on recreationalists, while the town of Orleans would allow consistent ORV access resulting in a beneficial effect. The impact of alternative C in conjunction with the impacts of these actions result in both beneficial and adverse cumulative impacts on visitors over a long time period. Alternative C would contribute imperceptible increments to the overall cumulative impact because visitor use and experience are not anticipated to vary greatly from current conditions.

Conclusion. Alternative C would not substantially change visitor use and experience in the national seashore. There would be adverse impacts to some visitors as a result of prohibiting aerial activities from March 15 to October 15 and increased enforcement of shorebird protection measures that may limit access for bird and wildlife viewing. There would also be some beneficial effects on other visitors that do not want the visual and auditory intrusions of aerial activities, and there may be beneficial impacts if certain restrictions can be lifted earlier in the season due to increased nesting success from selective predator removals. The national seashore anticipates that there would be no new impacts to visitors during the off-peak season or to visitors not using the beach and shoreline resources. Alternative C would contribute imperceptible beneficial and adverse increments to the overall cumulative impacts. In the context of visitor enjoyment of the national seashore and providing appropriate recreational uses, the impacts of alternative C would be considered minor because while some visitors will notice more restrictions and other visitors may benefit from new or reduced restrictions. Overall, the majority of visitors would continue to use and experience the national seashore in the same way that they have in the past.

IMPACTS OF ALTERNATIVE D: MAXIMUM SHOREBIRD PROTECTION WITHOUT ADDITIONAL MANAGEMENT OF PREDATORS

Alternative D would result in adverse impacts to the largest number of visitors during the shorebird season. If visitors want to have a beach experience, they would do so only at one of the life-guarded beaches. Although the majority of visitors recreate at the life-guarded beaches, these beaches would experience more crowding due to the closure of other beach areas. Applying flexible management to piping plovers nesting on life-guarded beaches will prevent those sections of beach from being closed to visitor access due to nesting birds and maximize the available space for beachgoers. Crowding would diminish the enjoyment of some beachgoers when visiting the life-guarded beaches because there would be little room to spread out and have personal space. Since most of the national seashore would be closed to visitors in alternative D, parking lots would fill up earlier in the day at the life-guarded beaches and more often during the peak visitation season because these would be the only areas in the national seashore open to the public.

Access to other more secluded areas would be prohibited thus, restricting pedestrians, boat landing, wildlife watching, ORV use, pet access, and aerial activities. Visitors would be limited to areas of beach and shoreline where they could recreate within the national seashore and would further have to modify plans and specific location selection to accommodate additional closures and restrictions during peak visitation months. The Pole Line Road and Inner Dune Route would be closed for general and commercial ORV use. Impacts would be direct and indirect and adverse to the greatest number of visitors. Some visitors may choose to visit other locations on Cape Cod, or not to visit Cape Cod at all. Other visitors may appreciate their national seashore experience more without vehicles driving on beaches. There would be no new impacts during the off-peak season (October 16–March 14).

Alternative D would contribute noticeable adverse increments to the overall cumulative impact. Impacts to visitor use and experience resulting from the implementation of alternative D would be greater than the other three alternatives; recreational activities would be supported only in highly specific and concentrated areas of the national seashore during the peak visitation period and throughout the national seashore during the off-peak visitation period. In the context of visitor enjoyment of the national seashore and providing appropriate recreational uses, the impacts of alternative D would likely be substantial because the restrictions would be imposed during peak visitation, which means a large number of visitors would experience crowding on the limited beach that is open or would have to change their plans when visiting the park if all parking lots to the life-guarded beaches were full or if they wanted to recreate on nonlife-guarded sections of the park, which would be closed under this alternative. The park would make efforts to reduce adverse impacts through public information to help visitors plan their visits around restrictions and be prepared for potentially crowded conditions at high visitation areas.

Cumulative Impacts. Actions outside the national seashore and within the surrounding region that would have an effect on visitor use and experiences include the ORV ban in Eastham, ORV use in Orleans, and additional recreational restrictions at the Monomoy National Wildlife Refuge. The ORV ban and additional restrictions at Monomoy would have an adverse impact on recreationalists, while the town of Orleans would allow consistent ORV access resulting in a beneficial effect. The impact of alternative D, in conjunction with the impacts of these actions, would result in adverse cumulative impacts on visitors over a long time period. Alternative D would contribute noticeable adverse increments to the overall cumulative impact because visitor use and experience would be reduced in most areas of the national seashore and crowding of these areas would occur.

Conclusion. Impacts to visitor use and experience resulting from the implementation of alternative D would be greater than the other three alternatives; recreational activities would be supported only in specific areas of the national seashore during the peak visitation period and throughout the national seashore during the off-peak visitation period. Alternative D would also contribute a noticeable adverse increment to adverse cumulative impacts. In the context of visitor enjoyment of the national seashore and providing appropriate recreational uses, the impacts of alternative D would likely be substantial because the restrictions would be imposed during peak visitation, which means that a large number of visitors would experience crowding or would have to change their plans when visiting the park. The park would make efforts to reduce adverse impacts through public information to help visitors plan their visits around restrictions and be prepared for potentially crowded conditions at high visitation areas.

SOCIOECONOMICS AFFECTED ENVIRONMENT

Tourism, including that associated with the national seashore, generates tremendous economic value in Cape Cod and the surrounding region. Between 2008 and 2014, the national seashore received approximately 4.5 million visits per year, including residents and repeat visitors. A 2013 NPS report estimated that the more than 4.4 million visitors in 2012 spent over \$179 million within the national seashore and in nearby communities. That spending supported approximately 2,170 jobs in the area (Cullinane et al. 2014). Table 3 depicts the seasonal nature of these visits and increased visitation during the shorebird nesting season, with July and August receiving the highest visitation.

The national seashore is entirely within Barnstable County for which the 2010 US Census reported a resident population of 215,888 people. The 2010 census showed a decrease in the population size of most towns in Barnstable County as compared to their respective populations in 2000. The towns of Bourne, Mashpee, and Sandwich experienced population gains during that decade, with Mashpee registering the largest gains. Of the six large communities of the Outer Cape (Chatham, Orleans, Eastham, Wellfleet, Truro, and Provincetown), the population in Wellfleet basically stayed the same and the other five towns saw a decrease (table 6).

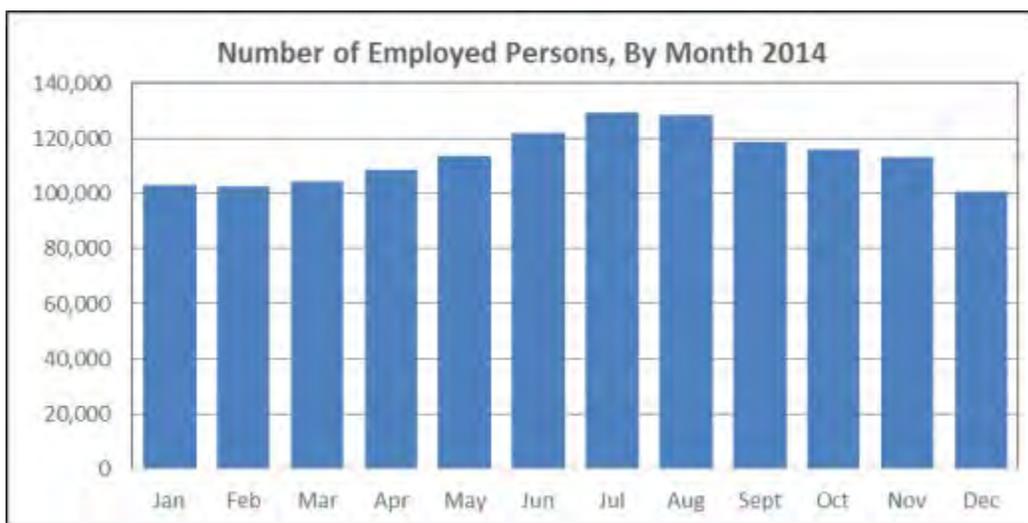
TABLE 6. US CENSUS DATA FOR BARNSTABLE COUNTY, MA 2000–2010

City or Town	2000	2010	% Change
Barnstable	47,821	45,193	-5.5
Bourne	18,721	19,754	5.5
Brewster	10,094	9,820	-2.7
Chatham	6,625	6,125	-7.6
Dennis	15,973	14,207	-11.1
Eastham	5,453	4,956	-9.1
Falmouth	32,660	31,531	-3.5
Harwich	12,386	12,243	-1.2
Mashpee	12,946	14,006	8.2
Orleans	6,341	5,890	-7.1
Provincetown	3,431	2,942	-14.3
Sandwich	20,136	20,675	2.7
Truro	2,087	2,003	-4.0
Wellfleet	2,749	2,750	0.0
Yarmouth	24,807	23,793	-4.1

Source: Massachusetts Office of the Secretary of the Commonwealth Census Liaison, 2012

According to the US Census Bureau, 2005–2009 American Community Survey, Barnstable County has a median household income of \$60,069, with an unemployment rate of 3.5%. The median household incomes of the larger Outer Cape Cod communities were presented as follows: (1) Chatham (\$64,824); (2) Orleans (\$55,919); (3) Eastham (\$55,675); (4) Wellfleet (\$63,042); (5) Truro (\$57,057); and (6) Provincetown (\$43,958).

A breakdown of the Cape Cod economic base identifies tourism as the largest segment representing 43% of the economy. Economic activity supported by retirement income represents the next-largest segment (15.3% of the economy), which, when combined with tourism represents two-thirds of the jobs in Barnstable County (Cape Cod Chamber of Commerce 2012). The economic concentration in tourism is underscored by data for Barnstable County from the 2012 County Business Patterns, which reported more than 2,800 establishments in the local retail trade, arts, entertainment, recreation, accommodation, and food service industries (US Census Bureau 2014b). Tourism’s strong seasonality is also reflected in local employment patterns whereby more than 26,000 jobs were added in July and August 2014 as compared to January and February (see figure 8).



Source: Massachusetts Office of Labor and Workforce Development, 2015

FIGURE 8. NUMBER OF EMPLOYED PERSONS, BY MONTH, 2014

Another indicator of the popularity of Cape Cod for seasonal residency and tourism is the size and utilization of the local housing stock. The 2010 Census reported 160,281 housing units in Barnstable County. Of the total, 95,755 units (59.7%) were either owner- or renter-occupied. However, nearly 57,000 other units were held for seasonal, recreational, or occasional use (US Census Bureau 2014a).

The Massachusetts Office of Labor and Workforce Development (2012 a, b) project short- and long-term employment increases in the arts, entertainment, and recreation industries as well as the accommodations and food services industries for Cape Cod and nearby islands.

Visitors to Cape Cod typically: (1) enjoy wildlife viewing, cultural resources, fishing, hunting, camping, hiking, ORV use, swimming and/or sunbathing; (2) require overnight accommodations at local hotels, campgrounds, or rental properties; (3) eat in local restaurants; and (4) require supplies and services for vehicles and recreational units, all of which are provided by local merchants. In

2011, about 1.8 million US residents (16 years and older) participated in wildlife viewing activities in Massachusetts, spending approximately \$1.3 billion on wildlife watching activities (including trip-related expenditures, equipment, and other related expenses) (USFWS 2011).

TOURS/CONCESSIONS/PERMITS

As described in the “Public Use” and “Visitor Experience” sections, the national seashore issued on average 4,854 ORV and SCV permits per year. A portion of the proceeds from these permits fund professional staff, including shorebird staff at the national seashore.

The national seashore has three concession contracts:

- Nauset Knolls Motor Lodge in East Orleans has 12 guest rooms overlooking Nauset Beach on the Atlantic Ocean, within the Cape Cod National Seashore. In 2015 it served 2,468 people.
- Far Land On the Beach Restaurant at Herring Cove Beach in Provincetown was established in 2013 and provides sandwiches, ice cream, and live music during the summer months to visitors. They served approximately 27,809 people in 2015.
- Highland Lights Link Golf Course in Truro is a nine-hole golf course and considered the oldest links course in America, established in 1892. It is listed in the National Register of Historic Places.

There are two major commercial use permits issued at the national seashore. Art’s Dune Tours, based in Provincetown, drives visitors onto the beach in 18 oversand (4x4) ORVs providing narrative tours through the national seashore (Truro and Provincetown). On average, there are 36 trips per day during the summer season, accommodating approximately 12,000 clients annually. Each trip travels along existing sand roads, along the inner dune routes to Exit 8, and then along sections of Race Point South. Each trip is about 45 minutes in duration. The national seashore is the exclusive destination for the tour.

Flyer’s Boat Rentals, also based in Provincetown, provides boat shuttle service to and from Long Point, Provincetown. Service is provided five to six days per week (weather permitting) shuttling approximately 1,900 visitors per year. The average trip is 7 hours long and the national seashore is the exclusive destination.

The following commercial use authorizations are permitted at beaches and marshes in the national seashore. These providers (underlined) and their associated activities generally occur from June through August:

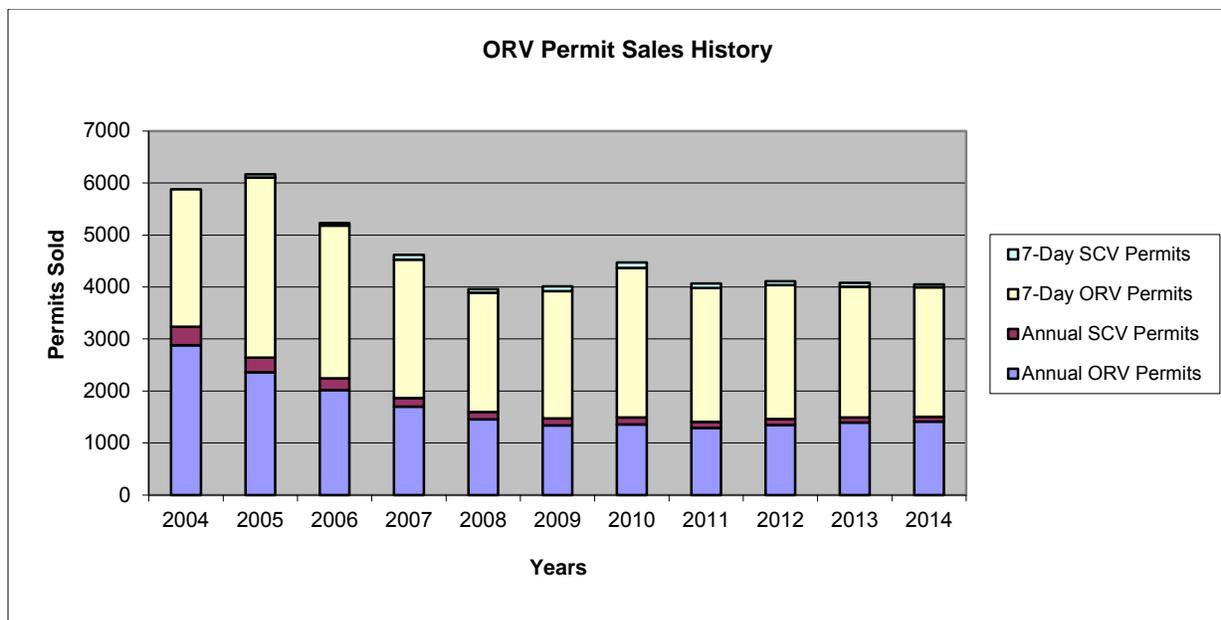
1. **Sugar Surf** (based out of Wellfleet) provides surf instruction for individuals aged six and up. They served approximately 500 visitors at the seashore last year.
2. **Sickday** (based out of Wellfleet) provides surf and stand-up paddleboard instruction. They served up to 350 visitors per season, six days a week during the summer, each visitor spending 2 to 9 hours a day at the national seashore.
3. **Sacred Surf School** (based out of Wellfleet) provides surf and stand-up paddleboard instruction. There are no data for the number of individual visitors they served last year.

4. **Fun Seekers** (based out of Wellfleet) provides surf instruction. Last year they served 400 visitors, operating 90 days in the national seashore, each spending 2 to 4 hours a day.
5. **Cape Side Surf School** (based out of Wellfleet) provides surf and stand-up paddleboard instruction. Last year they served 75 people during the summer season.
6. **Goose Hummock** (based out of Orleans) provides nature-guided tours for kayaking, fly fishing, and guided field trips. Kayak tours are conducted on Nauset Marsh and Pleasant Bay, fly fishing on Nauset Marsh, and field trips are led along Nauset Marsh Trail and Fort Hill Trail. Last year, they served 175 visitors; who spend 3 to 4 hours in the national seashore four to six days a week.
7. **Great Marsh Kayak Tours** (based out of Mashpee) provide educational-based kayak tours on Salt Pond and Nauset Marsh. Last year they served 250 visitors and made 25 trips to the national seashore.
8. **Cape Kayaking** (based out of Dennis) provides kayak tours, beach walks, bird-watching, seal watching, and shell fishing techniques within the boundaries of the national seashore. They served 250 visitors and made trips to the national seashore three days a week for four weeks for a total of 200 hours.
9. **P-Town Parties** (based out of Provincetown) provides clambakes on the beach; the national seashore issues these activities through special use permits. They served 633 visitors.

ORV Permit Sales

Figure 9 shows the permitting sales history for ORVs and SCVs within the national seashore from 2000–2014. Compared to the stormy weather in 2012 there were no major weather events that affected ORV use during the 2013 season. Total permit sales revenue increased by \$1,550 or by 0.4% in 2013 when compared to 2012. Total permit sales have declined 34% from a high of 6,164 permits in 2005 to 4,082 permits in 2013. However, total permit sales have been somewhat consistent over the five-year period from 2010–2014, ranging from approximately 4,000–4,500 total permits sold.

There were multiple weather events that affected ORV use during the 2014 season. The spring high tides caused two total vehicle closures of the ORV corridor and tropical storm Arthur closed the corridor over the July 4th weekend. Total permit sales revenue decreased by 0.8% when compared to 2013 sales; however, seasonal ORV permits increased 1.21% from 1,397 in 2013 to 1,414 for the 2014 season. The weekly ORV permits were down 0.75% from 2,514 in 2013 to 2,495 in 2014. Seasonal SCV permit sales decreased in 2014 from 95 issued in 2013 to 88 issued in 2014. Weekly SCV permit sales continued to decline by 31.57% in 2014 with 52 permits issued for 2014 compared with 76 for 2013. When compared to 2013, sales in 2014 overall sales declined only slightly. Portions of the North District national seashore staff, including portions of the Natural Resource Management Division shorebird staff are funded by the sale of ORV permits each year.



Source: 214 Cape Cod National Seashore Off-Road Vehicle Activity Report

FIGURE 9. ORV PERMIT SALES HISTORY 2004–2014

Influence of Climate Change on Socioeconomics

As stated earlier, climate change, which is anticipated to affect temperature, precipitation, frequency and intensity of extreme events (storms and drought), and accelerated sea level rise, can accelerate erosional processes causing beaches to erode and narrow. As beaches narrow, the lack of dry beach, especially at high tide, forces beachgoers and the highly mobile plover broods to come in close contact with one another, increasing the frequency and probability of human disturbance. The increased disturbance may result in the need for additional restrictions on recreational activities to prevent disturbance. The narrowing of beaches can also result in closures of sections of the ORV corridor. Seashore staff have observed beach narrowing at Coast Guard, Marconi, and Race Point Beaches, and more frequent closures of the ORV due to loss of beach in recent years. The narrowing of beaches and resulting closures would have a negative impact on local businesses providing recreational equipment and services, as well as reducing sales of ORV permits decreasing seashore funding.

Methodology

Social impacts typically include effects on population growth, housing, and community facilities and services. Economic impacts are often expressed in terms of the number and types of jobs supported by the national seashore, national seashore spending, visitor use at the national seashore, and the associated changes in the surrounding community in the form of visitor spending.

Resource-specific context for assessing impacts of alternatives to socioeconomics includes:

- The effect of changes in the level of visitor use at the national seashore, which contributes to visitor spending in the surrounding communities.

- The effect of changes in national seashore staffing and spending to operate the national seashore.

IMPACTS OF ALTERNATIVE A: NO ACTION

Under alternative A, shorebirds at the national seashore would continue to be managed under the current standard operating procedures (1994 rev. 2012). There would be no changes in existing access and use restrictions on visitors, commercial services, or park operations and spending. Therefore, alternative A would not result in any changes to the current socioeconomic scenario.

Cumulative Impacts. Alternative A would have no impacts on socioeconomics; therefore, there are no cumulative impacts.

Conclusion. Overall, alternative A would result in no change to socioeconomics. There would be no cumulative impacts.

IMPACTS OF ALTERNATIVE B: INCREASED PROTECTION AND FLEXIBLE MANAGEMENT PLUS ADDITIONAL MANAGEMENT OF PREDATOR IMPACTS (NPS PREFERRED ALTERNATIVE)

Alternative B provides a balance between maintaining recreational opportunities for visitors and increasing these opportunities in some areas while maintaining protection for shorebirds and expanding protection in other areas. Area closures and activity restrictions would be expanded to more areas in the park outside of high visitor use areas and lengthened by two weeks in most cases to increase protection for staging and migratory shorebirds. In addition, with selective predator removals, first nesting attempts may be more successful due to reduced predation on eggs and chicks, leading to fewer re-nesting attempts, which would shorten the nesting season and allow vehicle and visitor restrictions to be lifted sooner. This balancing of recreational opportunities would allow local businesses that rely on tourism and recreational use to have more consistency and predictability in business forecasting and planning.

Under a commercial use authorization, Art's Dune Tours would continue to have access to the ORV corridor with temporary closures of ORV routes during the summer season due to tides, beach configuration, and nesting and staging/migrating birds resulting in no change to current conditions. If shorebirds have successful first nesting attempts and chicks fledge earlier in the season, restrictions on the ORV corridor may be lifted sooner in the late summer season, which would result in beneficial effects to the tour operator later in the season.

Flyer's Boat Rentals would experience periodic boat landing closures at Long's Point. Closures under alternative B may be more frequent than under existing conditions and therefore, more adverse if tours and rentals are canceled. As they currently do, the tourist-related businesses on the Cape would continue to need to keep apprised of temporary beach and ORV route closures and adjust tours and destinations accordingly.

Other businesses with permitted commercial use authorizations would continue to experience periodic closures of some beaches to boaters and surfers. With 550 miles of shoreline along the Cape, outside the national seashore, and numerous marshes, ponds, and rivers, these businesses are able to operate in many areas outside the national seashore. Sections of Nauset Marsh Channel and

mud/sand flats may be closed (with rerouting options) more frequently under this alternative, resulting in the need for businesses to plan for using alternative routes or finding other destinations.

Visitors recreating and wildlife watching at the national seashore would continue to benefit the local economies through consumption of goods and services, equipment rentals, and other expenditures associated with recreational opportunities within the national seashore. Alternative B may result in changes in consumer spending. Some visitors may change plans and visit other destination on the Cape due to additional restrictions. The national seashore could see an increase of visitor during the late summer if restrictions are lifted earlier resulting in more local spending.

National seashore management and staff would coordinate with wildlife specialists from the USDA APHIS-Wildlife Service to implement lethal predator management removal providing special status shorebird species protection. Most of the contracted funding would be spent locally but it would not result in an economic increase or decrease.

Cumulative Impacts. Actions outside the national seashore and within the surrounding region would have an effect on socioeconomics include an ORV ban in Eastham, ORV use in Orleans, and additional recreational restrictions at the Monomoy National Wildlife Refuge. The ORV ban and additional restrictions at Monomoy would have an adverse impact on socioeconomics due to potential reduction in visitor spending and rentals, while the town of Orleans would allow for consistent ORV access resulting in a beneficial effect. The impact of alternative B, in conjunction with the impacts of these actions, would result in both beneficial and adverse cumulative impacts on socioeconomics and would occur over a long time period. Alternative B would contribute imperceptible adverse and beneficial increments to the overall cumulative impact because the number of visitors and visitor spending is not expected to change from current conditions.

Conclusion. Under alternative B, adverse impacts would continue to occur during periodic beach and ORV corridor vehicle closures because some visitors may avoid visiting the Cape. Some visitors may opt to visit other destinations on the Cape due to restrictions or visit at different times of the year; however, businesses would continue to support visitors that visit the Cape, which would result in no change to the local economy. Businesses that rely on tourism and recreation would benefit from more predictable restrictions and closures, and therefore plan accordingly. Beneficial impacts to socioeconomics would result from more consistent use of life-guarded beaches, a likely decrease in the length of the shorebird breeding and nesting protection season, and an increase in the number of recreational users having access to some beaches and vehicle access along the ORV corridor during late summer. Alternative B would contribute imperceptible beneficial and adverse increments to the overall cumulative impact. The effects of alternative B could result in increased spending by visitors in local communities and at the national seashore during the late summer season. Overall, alternative B would not generally change existing socioeconomic conditions. However, lifting restrictions earlier in the season could result in increased recreational user days and correspondingly increased spending by recreationists in local communities and at the national seashore. This would be slightly more beneficial than alternative A.

IMPACTS OF ALTERNATIVE C: CURRENT MANAGEMENT ACTIONS PLUS ADDITIONAL MANAGEMENT OF PREDATOR IMPACTS

Under alternative C, current management actions would remain in place with the addition of lethal selective predator management. This means that socioeconomic conditions would generally remain the same but there is potential for additional beneficial impacts under alternative C because of possible lifting of beach and ORV corridor vehicle restrictions earlier in the season due to more

successful first nesting attempts by special status shorebird species. This may extend the beach-going season and tour operators to resume business earlier, meaning fewer visitors may change their plans or they may extend their visit, resulting in additional spending. ORV permit sales would not be expected to change due to shorebird management; permit sales revenue would continue to fund a portion of seashore staff.

Cumulative Impacts. Actions outside the national seashore and within the surrounding region would have an effect on socioeconomics include an ORV ban in Eastham, ORV use in Orleans, and additional recreational restrictions at Monomoy National Wildlife Refuge. The ORV ban and additional restrictions at Monomoy would have an adverse impact on socioeconomics due to potential reduction in visitor spending and rentals, while the town of Orleans would allow for consistent ORV access resulting in a beneficial effect. The impact of alternative C, in conjunction with the impacts of these actions, would result in both beneficial and adverse cumulative impacts on socioeconomics and would be over a long time period, with alternative C contributing a slight beneficial increment to the overall cumulative impacts.

Conclusion. Overall, alternative C would not generally change existing socioeconomic conditions. However, the use of lethal selective predator management may allow shorebird breeding and nesting restrictions to be lifted earlier in the season, therefore, resulting in a slightly greater, direct beneficial effect than alternative A. Alternative C would contribute an imperceptible beneficial increment to the overall cumulative impact. The effects of alternative C could result in an increase in recreational user days and correspondingly increased spending by recreationists in local communities and at the national seashore. This would contribute a minor beneficial effect to the local economy. Lethal predator management activities would contribute negligibly to the local economy through increased national seashore spending.

IMPACTS OF ALTERNATIVE D: MAXIMUM SHOREBIRD PROTECTION WITHOUT ADDITIONAL MANAGEMENT OF PREDATOR IMPACTS

Under alternative D, all historic shorebird use areas and other priority habitats including entire sections of beaches (i.e., from bluff toe to waterline), would be closed except for the six life-guarded beaches.

Under alternative D, most, if not all of the ORV corridor and boat landing sites would be closed from March 15 until October 15. Art's Dune Tours would have minimal opportunities to offer ORV tours of the front beach during the peak visitation period in the national seashore. Pole Line Road, when open, would not be available for commercial use. Flyer's Boat Rentals would also experience landing closures at Long's Point. These closures would require changes to where ORVs and boaters can access and could result in some loss of business during the peak visitation period. Restrictions on the ORV corridor and boating may be lifted sooner in the late summer season if first nesting attempts are successful.

Businesses with permitted commercial use authorizations would likely be operating at a minimum in the national seashore. With 500 miles of shoreline along the Cape outside the national seashore and numerous marshes, ponds, and rivers, some businesses would be able to operate in many areas outside the national seashore.

Local economies may experience a reduction in consumption of goods and services, equipment rentals, and other expenditures associated with beach closures and diminished recreational and wildlife watching opportunities in the national seashore. The tourist-related businesses on the outer

Cape could experience decreases in sales due to beach restrictions and temporary closures during the peak visitation period. Some visitors may opt to visit other locations outside the national seashore with fewer restrictions on activities, or choose not to vacation on Cape Cod.

Alternative D may reduce NPS support to the local economy because of changes in spending. Less staff time would be allocated to monitoring nesting and staging shorebirds, patrolling and interacting with visitors, implementing high-tide closures and detours. Symbolic fencing would still be installed, but there would be less need for daily adjusting of the fenceline and buffers due to complete closures of areas. This alternative may result in less seasonal staff being hired. Less funds would be allocated to purchasing supplies. The national seashore would lose revenue generated by ORV permit sales; however, this reduction would be offset by the reduced need for seasonal staff.

Cumulative Impacts. Actions outside the national seashore and within the surrounding region would have an effect on socioeconomics including the ORV ban in Eastham, ORV use in Orleans, and additional recreational restrictions at Monomoy National Wildlife Refuge. The ORV ban and additional restrictions at Monomoy would have an adverse impact on socioeconomics due to potential reductions in visitor spending and rentals, while the town of Orleans would allow consistent ORV access resulting in a beneficial effect. The impact of alternative D, in conjunction with the impacts of these actions, would result in adverse cumulative impacts on socioeconomics and would be over a long time period. Alternative D would contribute noticeable adverse increments to the overall cumulative impact because visitor and park spending would likely decrease from current conditions.

Conclusion. Alternative D would result in adverse impacts to socioeconomics. Art's Dune Tours may find it difficult to continue operations within the national seashore. Visitors might contribute less to the local economy due to temporary beach closures and diminished recreational opportunities. While some visitors may shift to other activities, including concession-based activities, other visitors may avoid the Cape altogether. The current NPS workforce and supply purchases would be slightly reduced resulting in direct and indirect adverse socioeconomic impacts to local economies. Alternative D would also contribute to overall adverse cumulative impacts due to reduced visitor/recreation/wildlife watching days. Impacts to the local economy resulting from the implementation of alternative D would be greater than the other three alternatives; recreational activities would be supported only in specific areas of the national seashore during the peak visitation period, resulting in less visitor spending. Although the effects of reduced national seashore staffing and expenditures would be minor, the changes to visitor spending would have a noticeable adverse effect to the local economy.

Chapter 4: Consultation and Coordination

SCOPING

INTERNAL SCOPING

Scoping is a process to identify the resources that may be affected by a project proposal and to explore possible alternative ways of achieving the proposal while minimizing adverse impacts. Internal scoping was conducted by an interdisciplinary team of professionals from Cape Cod National Seashore. Interdisciplinary team members met numerous times, beginning in the spring of 2011, to discuss the purpose and need for the project; various alternatives; potential environmental impacts; past, present, and reasonably foreseeable projects that may have cumulative effects; and best management practices. The team also gathered background information and discussed public outreach for the project.

EXTERNAL SCOPING

External scoping was initiated with the distribution of a scoping letter to inform the public of the proposal to protect shorebirds, to generate input on the preparation of this environmental assessment. A scoping meeting was held on May 26, 2011, and comments were received during the scoping period from May 26, 2011, through August 5, 2011. Scoping letters were mailed to various federal and state agencies and other interested parties on the national seashore mailing list. A press release was also sent to local news organizations. In addition, the scoping letter was posted on the NPS Planning, Environment, and Public Comment (PEPC) website.

During the scoping period, the National Park Service received 47 pieces of correspondence from the general public and organizations.

AGENCY CONSULTATION

Consultation under Section 7 of the Endangered Species Act – On January 15, 2010, in accordance with the requirements of Section 7(a) of the Endangered Species Act of 1973, Cape Cod National Seashore initiated a formal consultation on the potential impacts of implementing flexible management options for federally listed piping plovers (*Charadrius melodus*) nesting on or near high-volume beach access points. In a letter dated May 11, 2010, the US Fish and Wildlife Service issued a biological opinion, including an incidental take permit for the 2010–2011 nesting seasons. In a letter dated April 13, 2012, the national seashore requested an extension to this biological opinion to cover the 2013–2014 nesting seasons and again on January 26, 2014, to cover the 2015–2020 nesting seasons, which was granted. Consultation with the US Fish and Wildlife Service under section 7 has been ongoing through development of the shorebird management plan and this plan and environmental assessment incorporates their information and recommendations.

Section 106 of the National Historic Preservation Act – In accordance with section 106 of the National Historic Preservation Act, the National Park Service will provide the Massachusetts SHPO an opportunity to comment on the effects of this project with regard to historic properties. The National Park Service submitted an informational scoping letter to the SHPO on June 3, 2011.

Federal Consistency Review under the Coastal Zone Management Act – The Coastal Zone Management Act of 1972 gives states the authority to review federal projects to ensure they meet

state standards articulated in their coastal zone management plans through a process called federal consistency review. Federal consistency review is required for most projects that: (1) are in or can reasonably be expected to affect a use or resource of the Massachusetts coastal zone, and/or (2) require federal licenses or permits, receive certain federal funds, are a direct action of a federal agency, or are part of outer continental shelf plans for exploration, development, and production.

The current list of NPS activities that have been determined by Massachusetts to have reasonably foreseeable effects on coastal uses or resources and therefore may be subject to federal consistency review by the Massachusetts Office of Coastal Zone Management (2011) without further approval from the National Oceanic and Atmospheric Administration or other federal agency includes: “location, design, construction, or disposal of facilities; real property acquisition or disposal.” Listed USDI license or permit activities include: “Outer Continental Shelf Lands Act Section 5(e) granting rights-of-way for oil and gas pipelines in the Outer Continental Shelf and Endangered Species Act section 10 permits.” None of these activities are a part of this proposed management plan and therefore no further consultation is required.

Chapter 5: Appendixes, References, Glossary, and Preparers

APPENDIX A: USFWS CORRESPONDENCE

**MAY 2010: USFWS BIOLOGICAL OPINION TO NATIONAL SEASHORE
RE: FLEXIBLE MANAGEMENT**



United States Department of the Interior



FISH AND WILDLIFE SERVICE

New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087
<http://www.fws.gov/newengland>

May 11, 2010

Mr. George F. Price, Jr.
Superintendent
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA 02667

Dear Mr. Price:

This responds to your January 15, 2010 request for formal section 7 consultation in regard to the flexible management of federally-listed threatened piping plovers (*Charadrius melodus*) at two beaches on Cape Cod National Seashore (Seashore) in Massachusetts. This document represents the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) on the effects of the action on the piping plover in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (ESA). The BO is based on information provided in your January 15, 2010 project proposal and amendments to the proposal, electronic correspondence and telephone calls between Seashore and New England Field Office (NEFO) staff.

I. CONSULTATION HISTORY

October 26, 2009 – Meeting among Seashore, Service regional, and NEFO staff to review 2009 plover breeding season issues, including limited pedestrian visitation at Marconi Beach as a result of the unusually narrow beach and one nesting pair near the staircase entry. Management options for the 2010 season were also discussed.

November 11, 2009 – Telephone call between the Seashore and NEFO to discuss management options.

December 12, 2009 – Telephone call between the Seashore and NEFO outlining section 7 consultation procedures and requirements to initiate formal consultation.

December 21, 2009 – Telephone call between the Seashore and NEFO reviewing flexible management options.

January 15, 2010 – Letter to NEFO from the Seashore requesting initiation of formal section 7 consultation.

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February 2, 2010 – Electronic correspondence from the Seashore to NEFO providing a revised project description.

March 18, 2010 – Letter to NEFO from the Seashore amending the project description to include selective predator management.

April 2, 2010 – Electronic correspondence from NEFO to the Seashore providing the draft BO for review and comment.

April 8, 2010 – Electronic correspondence from the Seashore to NEFO submitting an overview of Cape Cod National Seashore Selective Predator Management Program 2010.

April 14, 2010 – Electronic correspondence from the Seashore to NEFO providing comments on the draft BO.

April 26 – 28, 2010 – Electronic correspondence and telephone conversations between the Seashore and NEFO regarding the Seashore's decision not to implement selective predator management in 2010. The Seashore will prepare a comprehensive shorebird management plan including a review of selective predator management as a possible tool to enhance shorebird productivity in the future.

II. BIOLOGICAL OPINION

This BO addresses the effects of all activities associated with the Seashore's proposed management of pedestrian access in occupied piping plover breeding habitat at one to two beaches in the context of the Seashore's ongoing intensive piping plover conservation program.

DESCRIPTION OF THE PROPOSED ACTION

The Seashore, a unit of the National Park Service located on outer Cape Cod in Massachusetts, is comprised of 44,600 acres of marine, estuarine, freshwater, and terrestrial ecosystems (<http://www.nps.gov/Seashore/naturescience/index.htm>). Nearly five million people visit the Seashore annually. The beaches, sand spits and tidal flats of the Seashore are used by breeding piping plovers and recreational visitors, requiring intensive management to maintain and promote piping plover recovery while allowing concurrent recreational use.

Two of the most frequently visited beaches, Marconi and Coast Guard Beaches, provide suitable nesting habitat for piping plovers, although much of Marconi Beach is not considered to be prime ("A-ranked") nesting habitat (MADFW 1996). Historically these beaches have been wide enough to permit pedestrian passage past piping plover nests. In 2009, Marconi Beach eroded to a width of approximately 20 to 60 meters from mean high tide to the base of the dune scarp. That summer, a piping plover nest was located immediately south of the sole pedestrian access point. The Seashore erected a buffer around the nest as recommended by the Service's *Guidelines for managing recreational activities in piping plover breeding habitat on the U.S. Atlantic Coast to*

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avoid take under Section 9 of the Endangered Species Act (Guidelines) (USFWS 1994) to protect the nesting pair from disturbance by pedestrians. The symbolically-fenced (stake and twine) buffer prevented use of the recreational beach adjacent to the stairway and, at high tide, prevented pedestrian passage to the beach south of the closure. Up to three staff members were required to monitor the plovers and guide visitors to open parts of the beach.

Marconi Beach receives approximately 10,000 to 13,000 visitors per week during the summer season. If piping plovers were to nest simultaneously on either side of the access point when the beach is narrow, a total closure could result in a significant loss of visitor use of the beach and economic impacts to the surrounding community. The action proposed by the Seashore consists of limited flexible management to allow visitation of Marconi Beach, Coast Guard Beach or other life-guarded pedestrian beaches in the event piping plovers nest near access points, and when strict adherence to the Guidelines would otherwise require beach closures.

The flexible management actions proposed by the Seashore will be implemented at no more than two pedestrian beaches if they meet the following criteria: 1) high pedestrian visitation similar to Marconi or Coast Guard Beaches; and 2) severe erosion. The eroded beach must be so narrow that pedestrian access is restricted to low tide if the Service's recommended buffer of a 50-meter radius around a nest were to be implemented. Moreover, should it be determined that two beaches need pedestrian access past suitable plover nesting habitat, no more than 250 meters at one beach and 150 meters at a second beach will be managed using the proposed actions for a maximum of 400 meters of beach park-wide. The Seashore estimates that the proposed management may affect one to three pairs of plovers during the years that it is implemented. It is anticipated that within the 250-meter section of unfenced beach, no more than two plover pairs would be affected, and within the 150-meter section of unfenced beach, one plover pair would be affected. The Seashore will monitor the flexible management area daily to assess whether additional pairs are attempting to establish territories. If the Seashore observes a fourth pair attempting to establish a territory within the flexible management area, one pair will be managed according to the Guidelines.

The Seashore will continue to manage piping plovers on pedestrian and recreational vehicle beaches according to past practices and consistent with the Guidelines, with the exception of the placement of symbolic fencing of up to 400 meters of beach. Specifically, the Guidelines require that:

- On portions of beaches that receive heavy human use, areas where territorial plovers are observed should be symbolically fenced to prevent disruption of territorial displays and courtship.
- On beaches where pedestrians...or other recreational users are present in numbers that could harm or disturb incubating plovers, their eggs, or chicks, areas of at least 50-meter radius around nests above the high tide line should be delineated with warning signs and symbolic fencing.
- In cases where the nest is located less than 50 meters above the high tide line, fencing should be situated at the high tide line.
- Fencing around nests should be expanded in cases where the standard 50-meter radius is inadequate to protect incubating adults or unfledged chicks from harm or disturbance.

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The Seashore proposes specific management actions that will permit pedestrian passage past piping plover nests on no more than 400 meters of extremely narrow beaches in contrast to Service recommendations for fencing piping plover habitat. These new actions include:

1. No installation of symbolic fencing at up to 250 meters of suitable nesting habitat adjacent to a pedestrian access point regardless of plover presence and/or breeding behavior (including nest scraping or courtship behavior).
2. No installation of predator exclosures (wire cages placed around nests, a key management tool in the early years of the recovery program) irrespective of documented predator presence should plovers establish a nest in the unfenced area and it is deemed likely that the adults could be harmed by flying into the exclosure if started.
3. Installation of a lateral buffer of at least 40 meters on either side of the nest found within areas proposed for flexible management and a smaller buffer between the nest and high tide line. The reduced buffer will allow a pedestrian corridor between the nest and high tide line, but provide only a minimal buffer between the nest and pedestrians.
4. A reduced buffer for broods from nests hatched within the flexible management area as a travel corridor and refuge for chicks; however, a pedestrian corridor will be maintained between the mean high tide line and the symbolically-fenced buffer.
5. Daily monitoring of the flexible management area to assess the number of piping plovers attempting to establish territories or nests.

The proposed flexible management will be implemented as needed in 2010 and 2011 while the Seashore prepares and finalizes a Comprehensive Shorebird Management Plan (S. Hall, Cape Cod National Seashore, pers. comm, April 28, 2010). The Comprehensive Shorebird Management Plan will identify and address the need for future flexible management, as well as additional conservation measures that might be used to offset losses from potential flexible management actions. Conservation measures that are not included in the proposed flexible management could include the use of selective predator management to enhance piping plover and other shorebird productivity, as well as mitigation actions not identified in this proposal.

Conservation measures

Long-standing beneficial monitoring and management actions implemented by Seashore staff include but are not limited to the following (management is described on pages 2-4 of the Project Proposal):

- Suitable piping plover nesting habitat and an ORV travel corridor are symbolically fenced with stakes and twine and posted with "area closed" signs in early April. The travel corridor is carefully monitored and relocated as needed in order to avoid disturbing breeding plovers (NPS 2007).
- Nests are located and approximate hatch dates determined through intensive monitoring.
- Predator exclosures are erected around nests unless risks are deemed to outweigh benefits, and checked daily.
- All nests are checked daily to determine sufficiency of buffers and need to install or remove predator exclosures.

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- Broods are monitored daily; broods near ORV corridors are often monitored twice a day.
- Productivity is documented and annually reported to the Massachusetts Division of Fisheries and Wildlife.
- Seashore staff conducts piping plover outreach to visitors through personal encounters, presentations and informational signage, and patrols beaches to ensure compliance with Seashore regulations.
- The Seashore maintains an extensive volunteer program to assist in plover and other shorebird conservation activities.

STATUS OF THE SPECIES

Piping plovers are small, sand-colored shorebirds approximately seven inches long (18 cm) with a wing span of approximately 15 inches (38 cm). The piping plover was listed as threatened in its Atlantic Coast breeding range under provisions of the ESA on January 10, 1986. The Atlantic Coast population breeds on coastal beaches from Newfoundland to North Carolina (and occasionally in South Carolina), and winters along the Atlantic Coast from North Carolina southward, along the Gulf Coast, and in the Caribbean. In 1996, the Service approved a revised recovery plan for the Atlantic Coast piping plover population (USFWS 1996). No critical habitat, as defined by the ESA, has been designated for the breeding habitat of the Atlantic Coast population.

The following is a summary of general life history drawn from the revised Atlantic Coast piping plover recovery plan (USFWS 1996) and the Piping Plover 5-Year Review: Summary and Evaluation (USFWS 2009b), unless otherwise stated.

Breeding

Piping plovers begin returning to their Atlantic Coast nesting beaches in early March. By early April, males begin to establish and defend territories and court females. Piping plovers are generally monogamous within a given year, but usually shift mates between years, and only occasionally between nesting attempts in a given year. Plovers are known to breed at one year of age, but the rate at which this occurs is unknown.

Piping plovers nest above the high tide line on coastal beaches, sand flats at the ends of sand spits and barrier islands, gently sloping foredunes, blowout areas behind primary dunes, sparsely vegetated dunes, and overwash areas cut into or between dunes. Clutch size is generally four eggs, and eggs are usually incubated for 27-30 days before hatching. Incubation is shared equally by both sexes. As a rule, piping plovers fledge only a single brood per season, but may re-nest several times if previous nests are lost.

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Piping plovers are territorial nesters, defending both nesting and brood rearing territories from conspecifics¹ (Wilcox 1959; Cairns 1977). Observed nesting densities are highly variable. Wilcox (1959) reported that nests of adjacent pairs are usually spaced 200 feet or more apart and are seldom closer than 100 feet. Although nesting density is partly a function of available birds (USFWS 1996), nesting densities also vary with habitat quality. Provisional density objectives for Massachusetts piping plover habitat described in a 1996 Conservation Plan (MADFW 1996) ranged from 24 pairs per mile for "A+"-ranked habitat to two pairs per mile for lower quality "C"-ranked habitat. Elias-Gerken (1994) noted contrasting densities of pairs within her study area on New York's central barrier islands; in 1992, she located 2.1 pairs per kilometer on Westhampton Island and 1.8 pairs per kilometers on Jones Island, compared with 0.2 pair per kilometers on Fire Island.

Upon hatching, flightless piping plover chicks may walk hundreds of meters from the nest site during their first week of life (Table 1 in USFWS 1996). Adults lead the chicks to and from feeding areas, shelter them from harsh weather, and protect young from perceived predators. Jones (1997) studied home ranges of piping plovers at the Cape Cod National Seashore in Massachusetts and observed that most broods moved an average of 500 meters (~1,600 ft.) from their nests after hatching and before fledging. Two plover families with chicks within 16 to 21 days old were found to forage up to 1,000 meters (~3,300 ft) from their nests. Plover broods have also been observed to move up to 1,600 meters (~1 mile) from their nest and back in one day, and have moved maximum distances of more than 4,000 meters (~2.5 miles) before fledging (Jones 1997).

Chicks remain together with one or both parents until they fledge (are able to fly) at 25 to 35 days of age. Depending on the date of hatching, unfledged chicks may be present on beaches from late May through late August, although most have fledged by the end of July.

Adult piping plovers generally demonstrate nest site fidelity, returning to the same breeding beach or a nearby beach in consecutive years, while fidelity of first-time Atlantic Coast breeders to natal sites is low. In New York, Wilcox (1959) recaptured 39% of the 744 adult plovers that he banded in prior years (many were recaptured during several successive seasons and all but three of them were re-trapped in the same nesting area), but recaptured only 4.7% of 979 plovers that he banded as chicks. He also observed that males exhibited greater fidelity to previous nest sites than females. Strauss (1990) observed individuals that returned to nest in his Massachusetts study area for up to six successive years, but mean distance between natal and breeding sites was 25.3 kilometers (n=6, range 9-40 kilometers). Also in Massachusetts, 13 of 16 birds banded on one site were resighted the following season, with 11 nesting on the same beach (MacIvor *et al.* 1987). Of 92 adults banded on Assateague Island, Maryland, and resighted the following year, 91 were seen on the same site, as were eight of 12 first-year birds (Loefering 1992).

Piping plovers rarely move great distances from one nest site to another after a nest failure. In a four-year study on outer Cape Cod, MacIvor (1990) documented only three adult plovers among 101 uniquely identifiable color-banded breeding pairs that changed beaches between re-nest

¹ Conspecifics are other members of the same species; in this case, other piping plovers.

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attempts in the same year. Distances from first nest site to re-nest site ranged from 8 to 23 miles (13 to 37 kilometers). Review of detailed breeding records for an estimated 501 pairs of piping plovers breeding in Massachusetts in 1999 by Melvin and Mostello (2000) included at least 14 pairs suspected of re-nesting at new territories on the same beach or at more than one site.

Plover foods consist of invertebrates such as marine worms, fly larvae, beetles, crustaceans, and mollusks. Feeding areas include intertidal portions of ocean beaches, overwash areas, mudflats, sand flats, wrack lines, and shorelines of coastal ponds, lagoons or salt marshes. Feeding activities of both adults and chicks occur during all hours of the day and night.

Factors affecting piping plovers

Loss and degradation of habitat due to development and shoreline stabilization have been major contributors to the species' decline. Beaches throughout the plover's range are affected by federal and non-federal actions, including inlet management, beach nourishment, dune construction, and dune stabilization. For example, throughout much of the New York-New Jersey recovery unit, periodic beach nourishment has interfered with natural coastal processes by precluding formation of newly-forming inlets, overwash zones, and accreting beach habitats that would create or revitalize piping plover nesting and foraging habitats (USFWS 2009b).

Continued efforts to conserve high quality habitats are warranted, but overall threats from recent or proposed projects are low in the New England recovery unit (USFWS 2009b). Since completion of the 1996 revised recovery plan, only one formal section 7 consultation has been conducted for a project involving habitat modification or degradation in New England (USFWS 2008). Informal consultations with the U.S. Army Corps of Engineers have resulted in project modifications to avoid direct and indirect adverse effects (including indirect effects from project-induced beach recreation) of beach nourishment or inlet dredging. Projects with the potential to degrade habitat have been proposed from time to time, but few have been implemented (USFWS 2009b). Although effects from past habitat loss and modification have diminished the piping plover's habitat base in New England, many high quality habitats remain, and piping plovers breed productively on a wide range of microhabitats (Jones 1997).

Disturbance by humans and pets often reduces the functional suitability of habitat and causes direct and indirect mortality of eggs and chicks. Recreational use of piping plover beaches includes pedestrian and vehicular activities. Unmanaged pedestrian and non-motorized recreational activities can be a source of both direct mortality and harassment of piping plovers. Pedestrians may disrupt plovers during territory establishment, courting, egg-laying and chick rearing. Intense pedestrian use of plover beaches may also prevent chicks from foraging, separate chicks from adults, and increase chicks' vulnerability to predation.

Most vehicle use in the vicinity of piping plovers in the New England recovery unit and elsewhere is managed in accordance with the Guidelines, although there are annual incidences of illegal beach driving. Vehicles can crush eggs (Wilcox 1959; Tull 1984; Burger 1987; Patterson *et al.* 1991; Shaffer and Laporte 1992) as well as adults and chicks. Plover nests and eggs are particularly difficult to detect during the six-to-seven-day egg-laying phase prior to initiation of full-time incubation, and are therefore vulnerable to destruction if nesting habitat is not protected

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with symbolic fencing and signage. However, the mobility of newly-hatched chicks does not lessen the susceptibility to destruction by vehicles. For example, in Massachusetts and New York, biologists documented 14 incidents in which 18 chicks and two adults were killed by vehicles between 1989 and 1993 (Melvin *et al.* 1994). Goldin (1993) compiled records of 34 chick mortalities (30 on the Atlantic Coast and four on the Northern Great Plains) due to vehicles. Biologists that monitor and manage piping plovers believe that many more chicks are killed by vehicles than are found and reported (Melvin *et al.* 1994).

Vehicles also significantly degrade piping plover habitat or disrupt normal behavior patterns. They may harm or harass plovers by crushing wrack into the sand and making it unavailable as cover or a foraging substrate (Hoopes *et al.* 1992; Goldin 1993), by creating ruts that can trap or impede movements of chicks (Jacobs 1988, in litt.), and by preventing plovers from using habitat that is otherwise suitable (MacIvor 1990; Strauss 1990; Hoopes *et al.* 1992; Goldin 1993; Hoopes 1994). Vehicles that drive too close to the toe of the dune may destroy "open vegetation" that may also furnish important piping plover habitat (Elias-Gerken 1994).

As described in the revised recovery plan, beach-raking machines remove the plovers' wrackline foraging habitat and pose mortality risks due to crushing or sweeping up eggs and chicks. Several recent studies (Elias *et al.* 2000, Cohen *et al.* 2009) have confirmed the importance of wrack as a foraging habitat. Jones (1997) suggested presence of wrack as a primary factor explaining breeding success of piping plovers without bayside access at the Cape Cod National Seashore. Jones (1997) also cited the potential for beach-cleaning operations to degrade habitat, since piping plovers often place their nests near cobble, wrack, or other natural debris. Indiscriminant use of beach-raking machines is a continuing threat to Atlantic Coast piping plovers.

Noncompliant pet owners who allow their dogs off leash have the potential to flush piping plovers, and these flushing events may be more prolonged than those associated with pedestrians or pedestrians with leashed dogs. Unleashed dogs may chase plovers, destroy nests, and kill chicks.

Predation has been identified as a major factor limiting piping plover reproductive success at many Atlantic Coast sites and substantial evidence shows that human activities are affecting types, numbers, and activity patterns of predators, thereby exacerbating natural predation. Predators of piping plover eggs and chicks include foxes, skunks, raccoons, rats, opossums, crows, gulls, grackles, hawks and falcons, domestic dogs and cats, and ghost crabs (USFWS 1996). As with other limiting factors, the nature and severity of predation is highly site-specific. Boettcher *et al.* (2007) identified predation as "the primary threat facing plovers in Virginia." Review of egg losses from natural and artificial nests at Breezy Point, New York, found that gulls, crows, and rats were major predators (Lauro and Tanacredi 2002).

Free-roaming domestic and feral cats, particularly those associated with human-subsidized feral cat colonies, appear to be an increasing threat to piping plovers and other beach-nesting birds. Examples of sites where feral cats have been identified as substantial threats to piping plovers since 2006 include Seabrook, New Hampshire; Brookhaven and Southampton, New York; Cape May City and the Borough of Stone Harbor, New Jersey; Cape Hatteras and Cape Lookout

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National Seashores, North Carolina (USFWS 2009b). Service biologists, state wildlife agencies, and conservation groups such as the American Bird Conservancy and National Audubon Society are working with local authorities and feral cat advocates to prevent and remove free-roaming cats in proximity to piping plover breeding areas.

Although predator numbers are undiminished or increasing, effectiveness of predator exclosures to protect piping plover nests has declined. Episodes of systematic harassment of incubating piping plovers (primarily by foxes, coyotes, and crows) and depredation at exclosures, elevated rates of nest abandonment, and incidents of adult mortalities associated with exclosed nests on the Atlantic Coast (Mostello and Melvin 2002; Melvin and Mostello 2003, 2007; USFWS 1996) and elsewhere (Murphy *et al.* 2003) have caused managers to use exclosures more selectively. Cohen *et al.* (2009) found that exclosures improved nest survival, but not overall reproductive output on Westhampton Island, New York study sites, a result that has been echoed by studies of other plover species and of piping plovers in their Northern Great Plains breeding range (Neuman *et al.* 2004).

As effectiveness of exclosures has declined, managers have increased selective predator removal activities at many sites throughout the U.S. Atlantic Coast range (e.g., USDA 2006; NPS 2007; Cohen *et al.* 2009). Most predator removal efforts have focused on mammalian predators, but gulls and crows have been targeted at some sites (e.g., USFWS 2007; Brady and Ingelfinger 2008; USDA 2006). Boettcher *et al.* (2007) state that predator management is "one of the most important and expensive avian conservation measures being implemented on Virginia's barrier islands." Cohen *et al.* (2009) found that the number of chicks fledged per pair at Westhampton, New York increased with the annual number of cats and foxes trapped. Mean productivity at Maine sites where predator management was conducted was approximately double the productivity at sites without predator management in both 2007 and 2008 (USDA 2006). Productivity of piping plovers at Plymouth Beach, Massachusetts averaged 1.67 fledged chicks per pair during three years when foxes were removed, compared with 0.86 chick per pair during the preceding seven years (USFWS 2009a). Following selective crow removal at Crane Beach in Ipswich, Massachusetts in 2008, piping plover productivity was the highest since 1999 and exceeded 1.25 fledglings per pair for first time since 2002 (Brady and Ingelfinger 2008).

Since the 1986 listing, major oil spills affecting Atlantic Coast piping plovers have included the World Prodigy (RI - 1989), B.T. Nautilus (NY and NJ - 1990), North Cape (RI - 1996), and Anitra (NJ - 1996). Implementation of piping plover restoration plans using funds collected from the responsible party has been completed or is in progress for all of these spills.

In April 2003, the Bouchard No. 120 (B-120) fuel barge apparently struck bottom in Buzzards Bay, Massachusetts and released approximately 98,000 gallons of No. 6 fuel oil. Within 24 hours, an oil slick approximately 10 miles long and two miles wide was observed in the Bay. The spill continued to spread, affecting approximately 90 miles of shoreline in and beyond Buzzards Bay. Approximately 26 extant or historic piping plover beaches were located within the area affected by the B-120 oil spill. Of these 26 beaches, piping plovers were documented to have nested at 13 sites in 2003, of which 12 were oiled and subjected to clean-up activities. Over 60 oiled plovers were documented and up to 55 pairs of plovers could have been affected by the oil

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and response activities. A natural resources damage assessment is underway that will quantify the injury (oil spill-induced mortality and lost productivity).

A detailed discussion of threats to Atlantic Coast piping plovers, including contaminants, wind turbines, effects of climate change and sea level rise and the reliability of effort and expenditures for conservation measures is found in the Piping Plover (*Charadrius melodus*) 5-Year Review: Summary and Evaluation (USFWS 2009b).

Rangewide Status and Recovery Objective

To facilitate an even distribution of the population, the Atlantic Coast piping plover recovery plan established four recovery units (Atlantic Canada, New England, New York-New Jersey, and Southern) and assigned a portion of the population target to each. These units are large enough that their overall carrying capacity should be buffered from changes due to natural habitat formation processes at individual nesting sites, while still assuring a geographically well-distributed population. Information indicates that most Atlantic Coast piping plovers nest within their natal region and that intensive regional protection efforts contribute to increases in regional piping plover numbers (USFWS 1996, 2009b).

Since listing under the ESA, the Atlantic Coast population has increased roughly 231%, from approximately 790 pairs to a preliminary estimate of 1,831 pairs in 2009 (USFWS 2010), while the United States portion of the population has almost tripled, from approximately 550 pairs to a preliminary estimate of 1,579 pairs. Even discounting apparent increases in New York, New Jersey, and North Carolina between 1986 and 1989, which likely were due in part to increased census effort, the population nearly doubled between 1989 and 2007. Population increases since 1989 have been highest in New England, followed by New York-New Jersey. Most growth in the Southern (DE-MD-VA-NC) recovery unit occurred between 2003 and 2005, while the Atlantic Canada population fluctuates from year to year with increases often quickly eroded in subsequent years (USFWS 2010).

While the observed population growth in recent decades is encouraging, periodic rapid declines in populations at the level of the individual recovery unit raise concerns about the long-term risk of extirpation faced by the Atlantic Coast population. For example, the Atlantic Canada population declined by 21% in just three years (2002-2005), and the southern half of the Southern recovery unit population declined by 68% in seven years (1995 - 2001). Pressure on Atlantic Coast beach habitat from development, human disturbance, and predation is widespread and unrelenting. The recovery of the Atlantic Coast piping plover population is occurring in the context of extremely intensive annual management that is implemented on almost all plover beaches, in both the United States and Atlantic Canada (USFWS 1996; RENEW 2003, 2004; Hecht and Melvin 2009).

The revised recovery plan for the Atlantic Coast piping plover (USFWS 1996) identified a recovery objective for delisting the species, as well as five criteria for meeting the recovery objective. The overall objective is to ensure the long-term viability of the Atlantic Coast plover population in the wild. Delisting of the Atlantic Coast piping plover population may be considered when the following criteria have been met:

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- increase and maintain for five years a total of 2,000 breeding pairs, distributed among four recovery units;
- verify the adequacy of a 2,000-pair population of piping plovers to maintain heterozygosity and allelic diversity over the long term;
- achieve a five-year average productivity of 1.5 fledged chicks per pair in each of the recovery units;
- institute long-term agreements to ensure protection and management are sufficient to maintain the population targets and average productivity in each recovery unit; and
- ensure long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution to maintain survival rates for a 2,000-pair population.

The New England recovery unit target is a minimum of 625 pairs. In 2009, there were approximately 735 nesting pairs of piping plovers in New England with an average productivity of 1.04 chicks per pair (USFWS 2010). Although the New England recovery unit population has exceeded (or been within two pairs of) the abundance goal since 1998, the average productivity is below the 1.5 chicks/pair threshold needed to maintain a secure population. Inclement weather and increased predation on both adults and young are the primary contributing factors that have been identified as limiting productivity in recent years.

The importance of productivity in driving Atlantic Coast piping plover population increases over the last 20 years notwithstanding, demographic models for piping plovers indicate that even small declines in adult and juvenile survival rates will cause substantial increases in extinction risk (Melvin and Gibbs 1994; Wemmer *et al.* 2001; Larson *et al.* 2002; Calvert *et al.* 2006). Elevated mortality of adults or post-fledglings has the potential to quickly undermine the progress toward recovery achieved at breeding sites. Calvert *et al.* (2006) found lower return rates of juvenile (first-year) birds to the breeding grounds in Canada than was documented for populations breeding in Massachusetts (Melvin and Gibbs 1994), Maryland (Loegering 1992), and Virginia (Cross 1996) in the late 1980s and early 1990s. This is consistent with low positive and negative growth in the Atlantic Canada population despite very high productivity (relative to other breeding populations) and extremely low rates of dispersal to the United States (Calvert *et al.* 2006). Thus, maximizing productivity does not ensure population increases; management must focus simultaneously on all sources of stress on the population.

Ten non-jeopardy formal biological opinions have been written for projects within the New England recovery unit since 1997. Most of the consultations were with the U.S. Coast Guard for marine event permits for fireworks events in coastal areas of Connecticut and Massachusetts (Table 1). These activities occur once a year and require follow-up reporting to assess take. Due to permit conditions incorporated in marine event permits issued by the U.S. Coast Guard, no plover egg or chick losses have been documented during the fireworks events. One consultation was written for the Army Corps of Engineers for maintenance dredging and disposal of dredged material on plover habitat and ultimately resulted in improved management and long-term benefits to the population utilizing the nourished beach. The B-120 oil spill consultation was based on spill response measures undertaken by the U.S. Coast Guard that resulted in the incidental take of eight eggs due to abandonment. The consultation identified measures to avoid adverse effects from oil spill response activities, thereby providing future protection to piping

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plovers under similar circumstances. One intra-service section 7 formal consultation with a National Wildlife Refuge managing piping plovers in Rhode Island recognized potential take of piping plovers or their chicks while limited numbers of vehicles were individually escorted when passing up to four broods.

Table 1. Previous biological opinions completed for piping plovers in New England.

Year	Project	Incidental Take		Project Completed
		Amount/Extent of Take	Documented	
1997-1998	Fireworks (Connecticut)	4 pairs of plovers and their broods/harassment	No mortality or loss of productivity	Yes
1997	Fireworks (Massachusetts)	2 pairs of plovers/harassment	No mortality or loss of productivity	Yes
1999	Beach nourishment/dredging (Maine)	2 pairs no productivity/harassment and mortality of young for the life of the project	1 pair 2002, no young, 1 pair 2003, 1 young	Yes, effects are ongoing
2000	Fireworks (Massachusetts)	1 egg /mortality 4 broods/harassment	No mortality or loss of productivity	Yes
2003	Fireworks (Connecticut)	2 pairs of plovers/harassment	No plovers present during event	Yes
2004	B-120 Oil Spill Response – post spill consultation	8 eggs lost to abandonment	Additional unquantifiable take due to harassment	Yes
2005 - 2007	Fireworks (Massachusetts)	1 egg lost to temporary abandonment, harassment of chicks younger than 10 days, up to 2 broods	No loss of eggs or chicks documented	Yes
2008	Cape Wind Energy Facility (Massachusetts)	10 piping plovers over the 20-year life of the project	No loss, project not yet implemented	No
2009	Quonochontaug Beach Management (Rhode Island)	2 chicks per year that may be harmed, harassed or killed by ORV use in occupied chick habitat	No mortality observed	On-going
2009	Fireworks (Connecticut)	Harassment of 1 adult pair of plovers and mortality of one to four chicks if less than three days of age at time of fireworks.	No plovers present during event (nest abandoned prior)	Yes

ENVIRONMENTAL BASELINE

The Cape Cod National Seashore monitors and manages piping plovers on 24 beaches located within the Seashore's approximately 40 miles of shoreline from Eastham to Provincetown, Massachusetts, approximately 30 miles of which may be suitable piping plover habitat of varying quality (MADFW 1996). The Seashore is divided into two districts: North District includes all beaches in Provincetown and Truro, South District includes all beaches in Eastham and

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Wellfleet. Some North District beaches allow off-road vehicle use as well as pedestrian use, while South District beaches are only used by pedestrians.

The Seashore manages piping plovers according to state and federal guidelines (MADFW 1993; USFWS 1994; details on pages 2–4 of the Project Proposal) in order to avoid adverse effects of disturbance from recreational activities occurring on the beaches. Labor-intensive plover management is implemented to achieve the maximum recreational benefits while adhering to state and federal plover management guidelines. The Seashore annually posts and symbolically fences approximately seven miles of suitable habitat historically known to have concentrations of breeding piping plovers, and maintains the fencing to preclude human disturbance until nesting is complete and birds leave the area. In the more remote areas, habitat is symbolically fenced as territorial pairs or piping plover nests are located during routine monitoring activities. Since 2004, portions of Jeremy Point and Coast Guard Beach (Eastham) were completely closed to pedestrian access (to the waterline) to protect nesting plovers and their broods. Portions of Great Island and Marconi Beaches are also periodically closed to all pedestrian access (pages 13 and 14, Project Proposal).

Additionally, the Seashore implements nonlethal predator management through the use of predator exclosures to reduce nest loss in situations where nest predation has been identified. Predator exclosures are closely monitored to minimize risks to adult piping plovers from predators keying in on the exclosures. The Seashore also has an established environmental education program on plover and other shorebird conservation for visitors and residents, and maintains a volunteer program to assist in plover and other shorebird conservation activities (e.g., 350 volunteer hours in 2009 (M. Hake, National Park Service, pers. comm., April 13, 2010)).

Largely due to the Seashore's intensive management program, the piping plover population increased from 18 nesting pairs in 1985 to 87 pairs in 2009. Currently, pairs nesting at the Seashore account for approximately 15% of all Massachusetts breeding plovers (page 2, Project Proposal) and, based on preliminary estimates, 5% of the rangewide population (USFWS 2010). Productivity is variable and often dependent on factors not limited by management, including weather, beach erosion and to some extent, predation. Documented productivity rose from 0.3 in 1986 to a high of 2.6 fledged chicks per pair in 1991. For at least fifteen years, the Seashore's five-year average productivity has met, exceeded or been slightly below the federal recovery goal of a five-year average productivity of 1.5 fledged chicks/pair (Figure 1, Project Proposal).

Productivity at most Seashore beaches declined significantly in 2009 due to a combination of late-season storms washing out nests and chicks, and avian and mammalian predation (Table 2). Bound Brook and Duck Harbor Beaches fledged one-third as many chicks in 2009 as in 2008, partly due to American crow predation (G. Price, National Park Service, correspondence, March 19, 2010).

Although the overall number of piping plover breeding pairs at the Seashore was similar between 2008 and 2009, the erosion of Coast Guard Beach may have caused piping plovers to shift to other beaches. The plovers that remained at Coast Guard Beach, primarily located at the southern end of the spit (considered to be prime nesting habitat), had the highest productivity of all

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Seashore beaches (1.71 chicks/pair). Marconi and Marconi Station Beaches (treated as one beach), located immediately to the north of Coast Guard Beach, increased from four pairs in 2008 to nine pairs in 2009, although productivity was poor (0.33 chick/pair). Head of the Meadow and High Head Beaches combined also increased by five pairs in 2009. Productivity was low at these beaches, primarily due to beach erosion degrading the nesting habitat, overwash of nests and predation.

Table 2. Piping plover breeding success at Cape Cod National Seashore beaches, 2007-2009.

Site	2007			2008			2009		
	No. Pairs	Chicks Fledged	Productivity ¹	No. Pairs	Chicks Fledged per site	Productivity ¹	No. Pairs	Chicks Fledged	Productivity ¹
Coast Guard	15	31	2.07	17	19	1.12	7	12	1.71
Nauset Light	0	0	0.00	0	0	0.00	0	0	0.00
Marconi Beach and Station	4	2	0.50	5	14	2.80	9	3	0.33
LeCompt	1	1	1.00	1	0	0.00	2	1	0.50
White Crest	0	0	0.00	1	0	0.00	0	0	0.00
Cahoon Hollow	0	0	0.00	0	0	0.00	1	0	0.00
Newcomb Hollow	0	0	0.00	1	0	0.00	1	0	0.00
Bound Brook/Duck Harbor ²	6	19	3.17	9	21	2.33	9	7	0.78
Great Island/Jeremy Point	9	14	1.56	10	23	2.3	7	4	0.57
Wood End/Long Pt ⁴	9	20	2.22	11	8	0.73	9	6	0.67
Race Point North	13	23	1.77	11	30	2.73	13	9	0.70
Race Point South	12	18	1.5	13	33	2.54	11	8	0.72
High Head/Head of the Meadow	10	13	1.3	6	10	1.67	15	5	0.33
Ballston Beach	2	3	1.5	1	0	0.00	3	5	0.67
TOTAL	81	144	1.78	86	158	1.84	67	60	0.70

Action Area

The action area, considered to be the area of direct and indirect effects, incorporates five "protected" beaches, i.e., beaches with lifeguard stations, and includes all piping plover suitable habitat within and adjacent to these beaches. The five protected beaches are: Coast Guard and Nauset Light Beaches in Eastham, Marconi Beach in Wellfleet, Head of the Meadow Beach in Truro, and Race Point and Herring Cove Beaches in Provincetown. The area of direct effects is limited to sections of one or two of the protected beaches at pedestrian access points with a

¹ Total number of chicks fledged/total number of nesting pairs.

² Proposed pilot predator management location.

⁴ Herring Cove Beach piping plover monitoring results included in Wood End/Long Point beaches results.

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maximum of up to 250 meters of beach at one site (measured from the access point), and a park-wide total of up to 400 meters.

Effects of the Action

In evaluating the effects of the federal action under consideration in this consultation, 50 CFR 402.2 and 402.14(g)(3) requires the Service to evaluate the direct and indirect effects of the action on the species.

Adverse effects

Direct effects - Direct adverse effects of the proposed action to piping plovers may result from the disruption of breeding behavior as piping plovers attempt to establish territories or nests within the unfenced areas adjacent to pedestrian access points. Pedestrians traveling through the unfenced habitat are likely to prevent piping plovers from establishing territories, disrupt courting behavior, trample nest scrapes and generally discourage plovers from successfully nesting within the unfenced areas. The Service expects that plovers would be displaced from that habitat, and most likely would promptly reinitiate courtship on nearby sections of fenced beach. Should a nest be found within the unfenced area, the Seashore will minimally symbolically fence the area in order to prevent the nest from being destroyed. Pairs selecting nest sites in unfenced sections of beach may be especially disturbance-tolerant; however, the minimal buffer between concentrated pedestrian access points and nesting plovers may cause incubating plovers to leave their nests, subjecting the eggs to fluctuating temperatures or predation and ultimately nest failure. Nevertheless, the symbolically-fenced area will minimize the potential for loss of eggs and/or chicks by ensuring a limited area is provided as a refuge from pedestrians. No direct injury or death of eggs or chicks is anticipated.

Exclosures erected to protect eggs from predators will be used within the flexible management areas if Seashore biologists determined that neither adult is likely to be at risk of running or flying into the wire mesh when startled by nearby pedestrians. Without exclosures, there could be an increase in nest predation potentially reducing productivity if the pair does not successfully re-nest within fenced habitat nearby.

The Service concurs with the Seashore's estimate that *no more than* three pairs of piping plovers are likely to nest along the affected sections of beach if they were fully fenced. Because these sections are (by definition) relatively narrow sections of beach without blowouts, overwash, or adjacent bayside habitat, reasonable *maximum* expected nesting densities would be eight pairs per 1.6 kilometers (1 mile) [those associated with "B" ranked habitats as described in the Conservation Plan for Piping Plovers in Massachusetts (MADFW 1996)] with more than 200 meters per territory. Under a worst-case scenario, the Service projects that up to three pairs of piping plovers could be displaced or disturbed due to reduced buffers. However, it is most likely that the proposed flexible management will affect one to two pairs based on the less than optimal habitat and the short duration of implementation (two years).

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In the context of abundant (approximately 11 kilometers) symbolically-fenced habitat elsewhere on these and nearby beaches on the Seashore and the additional kilometers of habitat closely monitored in order to erect additional fencing as needed, displaced breeding piping plovers are highly likely to nest elsewhere, albeit somewhat later in the season. Piping plovers are known to re-nest either within their original territory, establish new territories nearby, or rarely, move to another beach. Territory reestablishment and re-initiation of courting behavior would require additional energy similar to what occurs when nests are lost to flooding or predation. Later nesting plovers may have reduced productivity.

Indirect Effects - Indirect effects are defined as effects not immediately caused by the proposed action, but still reasonably certain to occur (50 CFR 402.02). Indirect adverse effects could occur if plovers displaced from areas not symbolically fenced attempt to establish nests in territories of other pairs, resulting in agonistic behaviors that disrupt territory establishment, courtship or incubation. However, these effects are unlikely to occur, in light of the extensive amount of highly suitable fenced nesting habitat available within the vicinity of the potential impact area and nearby Seashore beaches.

Interrelated and interdependent effects – The effects of the action under consultation are analyzed together with the effects of other activities that are interrelated to, or interdependent with, that action. An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. The Service does not anticipate any interrelated or interdependent effects.

Cumulative Effects

Cumulative effects include the effects of future state, local or private actions that are reasonably certain to occur in the action area considered in this BO. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. The Service is not aware of any future state, local or private actions that could occur within the action area that would not be subject to a section 7 review. Therefore, cumulative effects, as defined in the ESA, are not expected to occur within the action area and will not be addressed further in this BO.

CONCLUSION

After reviewing the current status of the Atlantic Coast piping plover in the New England recovery unit, as well as throughout the rest of its range, the environmental baseline for the action area, the effects of the proposed management actions and the cumulative effects, it is the Service's opinion that the flexible management proposed for a total of 400 meters of suitable piping plover habitat within the Seashore is not likely to jeopardize the continued existence of the Atlantic Coast piping plover population or the New England recovery unit. No critical habitat has been designated in New England for this species; therefore, none will be affected.

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The proposed flexible management is most likely to affect one to two (and no more than three) pairs of nesting piping plovers per year of implementation. Piping plover adults may be harassed and experience delayed nesting; however, no adults are anticipated to suffer direct or indirect mortality or be precluded from nesting as a result of the flexible management. Delayed nesting or disturbance to pairs nesting in the areas with reduced buffers near access points could result in a reduced rate of successful hatching and fledging, slightly affecting the productivity of piping plovers within the flexible management area.

The scale and context of the proposed action, affecting a maximum of 400 meters within a management unit that routinely has 11 kilometers of symbolically-fenced habitat, as well as containing additional areas of very intensively managed habitat, is a critical component of this evaluation. A reduction in productivity under a worst case scenario of up to three of 85 otherwise well-protected pairs at the Seashore in a recovery unit with 735 pairs (New England recovery unit, preliminary 2009 abundance estimate) is not anticipated to significantly affect overall annual productivity for the Seashore or the New England recovery unit. However, we note that any further reductions in protections would be cause for increasingly cautious evaluation. Further reductions at the Seashore of protected nesting habitat beyond what has been proposed would quickly accelerate more serious adverse effects, including effects on productivity and abundance of breeding pairs.

Additional factors incorporated into our analysis of whether the proposed flexible management would jeopardize the continued existence of piping plovers include conservation measures to reduce the extent of take—specifically, symbolic fencing erected around unanticipated nests within the flexible management area, outreach to minimize pedestrian disturbance to nesting plovers, and maintenance of a refuge area for chicks within the flexible management area. Furthermore, project effects will occur in the context of a recovery unit that has been at or near its target for recovery since 1998 and within a management unit (the Seashore) where piping plover abundance has increased from 18 pairs in 1985 to 87 pairs in 2009.

III. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of threatened or endangered species respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is defined by the Service as an act that actually kills or injures wildlife, and is further defined as significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity conducted by the federal agency or the applicant. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

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The Service anticipates that incidental take of the federally-threatened piping plover is likely to occur as a result of the loss or degradation of up to 400 meters of suitable nesting habitat in 2010 and 2011 when erosion would restrict pedestrian access at one or two selected beaches. Foregoing the use of symbolic fencing of up to 400 meters could cause one to two (and no more than three) pairs of breeding piping plovers to delay territory and/or nest establishment, potentially resulting in a slight but unquantifiable reduction in productivity for those plovers.

Disturbance to plovers nesting in a reduced buffer could result in a reduced rate of egg hatching success. The Service anticipates a slight reduction in egg hatching success for up to two pairs of plovers within the reduced buffer area.

The Service anticipates that one to two unexclosed nests could be predated within the flexible management area and cause affected pairs to re-nest. Since exclosures should only be used at sites with documented predation of nests and may not always be advisable, this take may not occur either year that flexible management is implemented. The Service anticipates a slight reduction of productivity for one to two pairs of plovers due to lack of exclosing a nest for those years when nest predation is a documented cause of reduced productivity.

Displacement, pedestrian disturbance and/or lack of exclosures for pairs nesting within reduced buffers are mutually exclusive. The worst case scenario for the proposed flexible management will result in reduced productivity for no more than three pairs of plovers. The Service anticipates that it is more likely that one to two pairs of piping plovers will be affected each year that the proposed management is implemented with a likely reduction in productivity of one fledged chick over the two-year period as a result of re-nesting due to disturbance or nest loss to predators.

Reasonable and Prudent Measures

Reasonable and prudent measures are measures considered necessary or appropriate to minimize the amount or extent of anticipated incidental take of the species. Reasonable and prudent measures, along with the terms and conditions that implement them, cannot alter the basic design, location, scope, duration, or limit of the action, and may involve only minor changes.

Pursuant to section 7(b)(4) of the ESA, the Service believes there are no reasonable and prudent measures necessary and appropriate to minimize take because all such measures (e.g., fencing for any pairs establishing nests in unfenced areas, changes in protocols for using exclosures) were explored during informal consultation and have been incorporated into the project description.

Terms and Conditions

Terms and conditions include, but are not limited to, monitoring and reporting requirements that are tailored to the nature of the action and the particular needs of the species involved. With the exception of the proposed flexible management, the Seashore implements the Guidelines for managing piping plovers at recreational beaches. No further terms and conditions are required other than reporting observed mortality or harm or harassment to piping plovers from pedestrian passage too close to nests or broods.

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Reporting and Monitoring Requirements

The Seashore must provide a report to NEFO of the piping plover nesting activities and conservation measures implemented within the flexible management area at the termination of the plover breeding season and copies of the site forms annually submitted to the Massachusetts Division of Fisheries and Wildlife. The contact for these reporting requirements is as follows:

Thomas R. Chapman, Supervisor
New England Field Office
U.S. Fish and Wildlife Service
70 Commercial St., Suite 300
Concord, NH 03301
(603) 223-2541

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. The following conservation recommendation is a discretionary agency activity to minimize or avoid adverse effects of a proposed action on listed species or proposed critical habitat, to help implement recovery plans, or to develop information.

Predator management: The Service recommends that predator management be a component of the Seashore's future Comprehensive Shorebird Management Plan. Selective predator removal would offset the potential reduction in productivity of flexible management should the Seashore propose such management in the Comprehensive Shorebird Management Plan.

Predation on beach nesting piping plovers has been a significant factor for reduced productivity at a number of New England beaches. The recent use of targeted predator management at sites that had been experiencing heavy predation losses has increased average productivity at a number of piping plover beaches. For example, predator management implemented at a beach in Ipswich, Massachusetts selectively targeted American crows known to forage within piping plover nesting habitat. Following two years of targeted American crow removal, Ingelfinger (2010) reported two consecutive years of productivity exceeding 1.25 chicks/pair for the first time since 1999. Predator management at Plymouth Beach, Massachusetts significantly increased productivity from zero chicks fledged the year prior to the implementation of predator management to 25 chicks the following year (USDA 2006; Melvin 2007). Based on ten years of data collected on causes of nest and chick loss, the Seashore documented that American crows were the primary predator of piping plover nests (page 3, Project Proposal), although mammalian and other avian predators have also affected productivity.

The Service conservatively estimates that in areas where selective predator removal is implemented, the long-term average productivity could increase by 20%. Although it is difficult to predict the increase attributed to predator management on an annual basis due to confounding factors such as severe weather and high tides causing nest and/or chick loss (USDA 2006;

Mr. George F. Price, Jr.
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Ingelfinger 2010), recent predator management programs in New England that have been implemented for two to three years indicate average productivity is generally higher than pre-predator management productivity. Significant increases in productivity have been consistently documented for one or more years following predator management at beaches in Maine, Massachusetts and New Hampshire that had been experiencing heavy predation (see Factors affecting piping plovers section herein, page 7).

Reinitiation Notice

This concludes formal consultation on the federal action outlined in the January 15, 2010 request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been maintained (or is authorized by law) and if 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this BO; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this BO; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, all activities that are causing such take must cease until such time as any necessary consultation is completed in order to avoid violation of section 9 of the ESA.

Sincerely yours,



Thomas R. Chapman
Supervisor
New England Field Office

Mr. George F. Price, Jr.
May 11, 2010

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CC: Reading file
Mary Hake, Cape Cod National Seashore
Scott Melvin, MADFW
Anne Hecht/RO
Glenn Smith/RO
David Brownlie, Monomoy National Wildlife Refuge
Stephanie Koch, Eastern Massachusetts National Wildlife Refuge Complex
ES: SvonOettingen:5-11-10:603-223-2541

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APPENDIX B: OTHER RELEVANT CORRESPONDENCE

1. Letter to State Historic Preservation Office
2. Letter to Tribal Historic Preservation Officer, Wampanoag Tribe of Gay Head-Aqinnah
3. Letter to the Mashpee Wampanoag Tribe Council



United States Department of the Interior

NATIONAL PARK SERVICE
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA 02667
508.771.2144
508.349.9052 Fax

IN REPLY REFER TO:

June 3, 2011

Ms. Brona Simon
State Historic Preservation Officer
Massachusetts Historical Commission
220 Morrissey Blvd.
Boston, MA 02215

Re: Environmental Assessment for Shorebird Management Plan

Dear Ms Simon:

Under the terms of the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act, the National Park Service (NPS) at Cape Cod National Seashore (CCNS) is preparing an Environmental Assessment/Assessment of Effect (EA/AoE) for the development of a Shorebird Management Plan. We will send you a copy of the EA/AoE once it becomes available.

CCNS beaches and inter-tidal zone provide significant nesting and staging habitat for the piping plover (*Charadrius melodus*) and roseate tern (*Sterna dougallii*). Both are federally listed under the 1973 Endangered Species Act. In addition, CCNS protects other state and federally listed species of special and/or conservation concern including the least tern (*Sterna antillarum*), common tern (*Sterna hirundo*), and the American oystercatcher (*Haematopus palliatus*). As a result, CCNS needs to prepare a comprehensive shorebird management plan. CCNS's most recent standard operating procedures (SOP) for shorebird management were prepared in 1994. However, conditions have changed over the years and the plan must provide sufficient details and direction for dealing with the present complexities and challenges of managing nesting and staging shorebirds and visitor use in habitats used by these birds. The EA/AoE will assess the effects of the proposed plan on cultural resources within an area of potential effect that will be defined in the project.

A public scoping meeting was held at CCNS May 26, 2011. The public comment period runs through July 29, 2011, and a decision/final plan issued is expected in spring 2012. If you have any questions regarding the project, please contact Bill Burke, Cultural Resources Program Manager, at bill_burke@nps.gov or (508) 255-3421, ext 14.

Sincerely,



George E. Price, Jr.
Superintendent

cc Mashpee Wampanoag Tribe
Wampanoag Tribe of Gay Head-Aquinnah



United States Department of the Interior

NATIONAL PARK SERVICE
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA 02667
508.771.2144
508.349.9052 Fax

IN REPLY REFER TO:

June 3, 2011

Bettina Washington
Tribal Historic Preservation Officer
Wampanoag Tribe of Gay Head - Aquinnah
20 Black Brook Road
Aquinnah, MA 02534-1546

Re: Environmental Assessment for Shorebird Management Plan

Dear Ms. Washington:

Under the terms of the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act, the National Park Service (NPS) at Cape Cod National Seashore (CCNS) is preparing an Environmental Assessment/Assessment of Effect (EA/AoE) for the development of a Shorebird Management Plan. We will send you a copy of the EA/AoE once it becomes available.

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Sincerely,



George E. Price, Jr.
Superintendent

cc Mashpee Wampanoag Tribe
Massachusetts Historical Commission



United States Department of the Interior

NATIONAL PARK SERVICE
Cape Cod National Seashore
99 Marconi Site Road
Wellfleet, MA 02667
508.771.2144
508.349.9052 Fax

IN REPLY REFER TO:

June 3, 2011

Mashpee Wampanoag Tribal Council
P.O. Box 1048
Mashpee, MA 02649

Re: Environmental Assessment for Shorebird Management Plan

Dear Mashpee Wampanoag Tribal Council:

Under the terms of the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act, the National Park Service (NPS) at Cape Cod National Seashore (CCNS) is preparing an Environmental Assessment/Assessment of Effect (EA/AoE) for the development of a Shorebird Management Plan. We will send you a copy of the EA/AoE once it becomes available.

CCNS beaches and inter-tidal zone provide significant nesting and staging habitat for the piping plover (*Charadrius melodus*) and roseate tern (*Sterna dougallii*). Both are federally listed under the 1973 Endangered Species Act. In addition, CCNS protects other state and federally listed species of special and/or conservation concern including the least tern (*Sterna antillarum*), common tern (*Sterna hirundo*), and the American oystercatcher (*Haematopus palliatus*). As a result, CCNS needs to prepare a comprehensive shorebird management plan. CCNS's most recent standard operating procedures (SOP) for shorebird management were prepared in 1994. However, conditions have changed over the years and the plan must provide sufficient details and direction for dealing with the present complexities and challenges of managing nesting and staging shorebirds and visitor use in habitats used by these birds. The EA/AoE will assess the effects of the proposed plan on cultural resources within an area of potential effect that will be defined in the project.

A public scoping meeting was held at CCNS May 26, 2011. The public comment period runs through July 29, 2011, and a decision/final plan issued is expected in spring 2012. If you have any questions regarding the project, please contact Bill Burke, Cultural Resources Program Manager, at bill_burke@nps.gov or (508) 255-3421, ext 14.

Sincerely,



George E. Price, Jr.
Superintendent

cc Wampanoag Tribe of Gay Head - Aquinnah
Massachusetts Historical Commission

APPENDIX C: SPECIAL STATUS SPECIES BACKGROUND AND THREATS

FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES

PIPING PLOVER

Piping plovers are small, sand-colored shorebirds (17–18 cm long, 43–63 g in weight), endemic to North America (Elliot-Smith and Haig 2004). Piping plovers arrive on their breeding grounds in mid-March, more than a month prior to nest initiation. During this period, the birds initiate courtship, select territory, and forage in preparation for the breeding season. Plovers spend from days to weeks in pair-bonding rituals and mating prior to initiating an actual nest. Nest scrapes may first be observed in late March, with the egg laying beginning in late April. A clutch of four eggs (USFWS 2007c, 2009a) are laid over about a week. Egg laying will occur through the end of June. Incubation by both parents lasts approximately 28 days. Pairs will re-nest if their nest is destroyed, but re-nesting after chicks hatch is rare (Elliott-Smith and Haig 2004). Piping plovers generally fledge only a single brood per season.

Plover chicks are precocial and leave the nest site within hours of hatching, accompanied by the adults. During the week after hatching, broods may move hundreds of meters away from the nest (USFWS 1996). Human disturbance can cause unfledged chicks to move unnecessarily (Strauss 1990; Burger 1991; Hoopes et al. 1992; Loegering 1992; Goldin 1993), out of preferred habitats, decreasing their time for feeding, and causing energy to be wasted (as cited in USFWS 1996). Most chicks fledge at about 25–35 days (USFWS 1996), although some develop much slower and can take up to 45 days. In general, most chicks have fledged by mid-August.

Piping plovers nest on sand, gravel, or cobble on open or sparsely vegetated beaches, barrier islands or sand spits, backshore, dune blowouts, and overwash fans (Elliot-Smith and Haig 2004) and occasionally in dense beachgrass at national seashore. On wide beaches, plovers may nest higher up on the beach to reduce the risk of flooding; however, nests placed closer to vegetated dunes may be at a greater risk for predation (Burger 1987). As presented in the recovery plan (USFWS 1996) an increasingly growing body of literature continues to support the importance of wide, flat, sparsely-vegetated beach habitats for the recovery of piping plovers with abundant moist substrates in conjunction with spits, washover areas, blowouts, ephemeral pools, unstabilized and recently closed inlets, and sparsely vegetated dunes (USFWS 2009a). This is generally true for the plovers found on national seashore beaches; where they nest on sections of the ocean and bayside beaches. The majority of nests are found on the berm and foredunes, but they may also nest on blowout areas behind primary dunes, and washover areas. Nests may be found in areas with little or no vegetation although, often, piping plovers will nest under stands of American beachgrass (*Ammophila breviligulata*) or other vegetation. Occasionally, nests are laid in the interdune or on the side of a bluff as much as 30 meters above the mean sea level. As winter storms reconfigure the beaches each year, the distribution of nests changes among the habitats.

Piping plovers feed on marine, freshwater, benthic, and terrestrial invertebrates (Elliot-Smith and Haig 2004) such as marine worms, crustaceans, beetles, fly larvae, or mollusks (USFWS 1996, 2009a). Plovers forage in intertidal zone washovers, mudflats, sandflats, wrack lines, and shorelines of coastal beaches, ponds, lagoons, salt marshes (Gibbs 1986; Coutu et al. 1990; Hoopes et al. 1992; Loegering 1992; Goldin 1993 as cited in USFWS 1996). Foraging adults prefer low-wave energy moist substrate habitats, as mudflats and sandflats, opposed to higher energy intertidal habitats during the early part of the breeding season (before egg laying) (Fraser et al. 2005, Cohen et al. 2010). The most important feeding habitat for adults and chicks includes the intertidal zone and wrack (Goldin et al. 1990; Hoopes et al. 1992). Chicks primarily feed on moist sand flats or other moist

substrates (Kuklinski et al. 1996; Cohen et al. 2009). Plover adults forage both day and night (Burger 1994a) and throughout the tidal cycle (Goldin 1993; Hoopes 1993). Chicks feed by day as they are brooded at night (Wolcott and Wolcott 1999).

Table C-1 and figure C-1 are an overview of piping plover nesting at national seashore from 1985 to 2014.

Table C-1. Number of Piping Plover Breeding Pairs, Annual Net Productivity, and 5-Year Weighted Average Productivity at the National Seashore, 1985–2014					
Year	Number of pairs	5-year average pairs	Number fledged	Annual productivity	5-year weighted average productivity
1985	18		13	0.70	
1986	16		5	0.30	
1987	15		6	0.40	
1988	13		12	0.90	
1989	15	15.40	21	1.40	0.74
1990	15	14.80	39	2.60	1.12
1991	28	17.20	74	2.64	1.77
1992	43	22.80	101	2.35	2.17
1993	60	32.20	124	2.07	2.23
1994	72	43.60	178	2.47	2.37
1995	83	57.20	147	1.77	2.18
1996	77	67.00	68	0.88	1.84
1997	67	71.80	104	1.55	1.73
1998	61	72.00	111	1.82	1.69
1999	72	72.00	123	1.71	1.54
2000	64	68.20	73	1.14	1.40
2001	76	68.00	155	2.04	1.66
2002	97	74.00	88	0.91	1.49
2003	84	78.60	130	1.55	1.45
2004	85.5	81.30	124	1.45	1.40
2005	77	83.90	87	1.13	1.39
2006	74	83.50	122	1.65	1.32
2007	82	80.50	146	1.78	1.51
2008	85	80.70	157	1.85	1.58
2009	83	80.20	60	0.72	1.43
2010	85	81.80	136	1.60	1.52
2011	82	83.40	90	1.10	1.41
2012	99	86.80	30	0.30	1.09
2013	85	86.80	46	0.54	0.83
2014	68.0	83.80	52.0	0.76	0.84

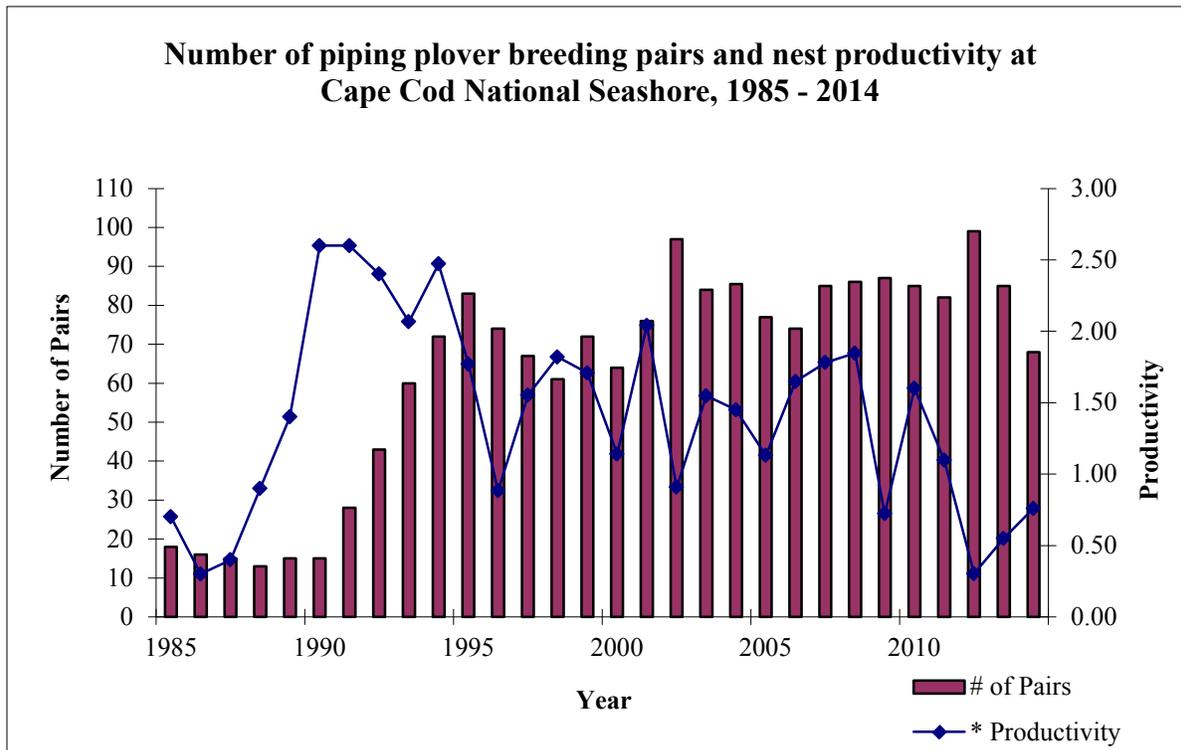


Figure C-1. Number of Piping Plover Breeding Pairs and Nest Productivity on Cape Cod National Seashore, 1985–2014

There has been an increase in the number of pairs from 18 pairs in 1985 to a high of 99 pairs in 2012. Overall productivity at the seashore in 2014 was 0.76 chicks/pair, which is comparable to what it was when plover management began in 1985. Annual plover productivity at the seashore increased dramatically in the initial years of the plover management program but has been trending downward more recently, with 25-year lows of 0.30 chicks fledged/pair in 2012 and 0.54 chicks fledged/year in 2013. Since 2000, the seashore has only met the USFWS recovery goals only four times in the last 15 years. However, because annual productivity can be so variable, a preferable measure of productivity is the five-year weighted average of annual productivity. This measure reduces the effect of annual variability and combines the results for five years into a single weighted average. For the Atlantic Coast population of piping plovers, viability models estimate that a five-year average annual productivity of 1.5 chicks fledged/pair/year is needed to maintain the relatively small recovery goal population of 2,000 pairs with minimal extinction risk (USFWS 1996, 2009). For the five-year period ending with 2014, the average productivity for piping plover at the national seashore was 0.84 chicks fledged/pair/year, which is the second lowest it has been at the seashore since 1989 (with 2013 being the lowest). Since 2000, the five-year annual productivity has narrowly reached the recovery goal four times in the past 15 years (table C-1). When viewed over a 20-year period (1995–2014), the five-year weighted average annual productivity has declined significantly by 0.0426 chicks/pair/year ($p < 0.0001$, $F_{1,18} = 36.14$, $r^2 = 0.6675$) (figure C-1). Productivity is in great decline and the national seashore is no longer achieving the USFWS recovery goal of a five year average annual productivity of 1.5 fledged chicks/pair/year. The number of nesting pairs within the national seashore has not drastically changed in recent years (68 to 99 pairs from 2001–2014); however, productivity is in great

decline (trending downward with 25-year lows of 0.30 chicks fledged/pair in 2012 and 0.76 chicks fledged/pair in 2014) and the USFWS recovery goal of a five-year average annual productivity of 1.5 fledged chicks/pair/year.

Tables C-2 and C-3 show the numbers of breeding pairs, fledglings, and productivity of piping plovers at 26 known nesting sites at national seashore over the last decade, 2004–2014. In tables C-2 and C-3, cells where data are not available in earlier years, is likely a factor of sites being clumped into one site and then later split into more individual sites (as described in the legend). From 2004 to 2014, a total of 1,049 chicks fledged from national seashore with an average annual productivity of 1.13 chicks fledged/pair (table C-3). This value is slightly higher than the five-year weighted annual productivity for 2014 calculated at 0.84 chicks fledged/pair (table C-1). Herring Cove/Wood End/Long Point, Race Point North, Race Point South, Coast Guard (Eastham), and High Head had the greatest total number of pairs ranging from 80–100 pairs (table C-2). These sites also generally had the highest productivity and produced the greatest number of fledglings. Number of chicks fledged from 2004–2014 at these most productive sites ranged from 81 (High Head) to 146 fledges (Coast Guard, Eastham) and the 10-year productivity ranged from 0.92 chicks fledged/pair (High Head) to 1.50 chicks fledged/pair (Coast Guard, Eastham) (table C-3). Other sites such as Longnook, Ballston, Marconi Station, White Crest, Bound Brook, Duck Harbor and Great Island also had good productivity although there were fewer pairs (tables C-2 and C-3). For the 10-year period of 2005 through 2014, the sites meeting or exceeding the New England Recovery Unit stationary population productivity requirement of at least 1.21 chicks fledged/pair/annually (Hecht and Melvin 2009) were Race Point South, Longnook, Ballston Beach, Coast Guard (Eastham), Cahoon Hollow, and Bound Brook; three sites recorded 1.19 chicks fledged/pair/annually from 2005 through 2014, they are Herring Cove/Wood End/Long Point, Race Point North, and Great Island (tables C-2 and C-3).

Table C-2. Number of Piping Plover Breeding Pairs By Site, Cape Cod National Seashore, 2004–2014

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total Pairs
Herring Cove/Wood End/Long Pt.	7	9	5	10	11	9	7	12	14	9	9	102.0
Hatches Harbor	3	4	3	3	1	2	1	2	1	1	0	21.0
Race Point North	12	11	14	13	11	9	9	8	7	6	7	107.0
Old Harbor ¹	0	0	0	0	0	2	2	2	1	1	0	8.0
Race Point South ²	16	17	11	12	13	3	5	5	3	1	4	90.0
Exit 9 ³	0	0	0	0	0	7	8	6	4	4	0	29.0
Armstrong ⁴	0	0	0	0	0	1	0	0	5	5	5	16.0
High Head ⁵	10	6	8	10	6	10	9	9	7	5	3	83.0
Dead Forest ⁶	0	0	0	0	0	1	0	0	0	0	0	1.0
Head of the Meadow ⁷	0	0	0	0	0	3	4	4	6	5	1	23.0
Coast Guard (Truro)	0	0	0	0	0	1	1	1	3	2	3	11.0
Longnook	0	0	0	0	0	0	0	1	2	2	1	6.0
Ballston Beach	3	3	3	3	1	3	5	6	9	8	8	52.0
Coast Guard (Eastham)	10	10	14	15	17	7	8	4	5	4	4	98.0

Table C-2. Number of Piping Plover Breeding Pairs By Site, Cape Cod National Seashore, 2004–2014

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total Pairs
Nauset Light	1	0	1	0	0	0	0	0	0	0	1	3.0
Marconi Beach	0	1	1	1	2	5	6	5	10	10	7	48.0
Marconi Station	4	2	2	3	3	4	0	0	0	0	0	18.0
LeCount Hollow	2	1	1	1	1	2	1	0	0	0	1	10.0
White Crest	1	1	0	0	1	0	1	0	1	1	2	8.0
Cahoon Hollow	3	1	0	0	0	1	0	1	2	0	0	8.0
Newcomb Hollow	1	1	1	0	1	1	2	0	3	2	3	15.0
Bound Brook	1	1	1	4	2	2	2	1	0	0	1	15.0
Duck Harbor	1	2	2	2	7	7	5	2	2	2	2	34.0
Great Island	8	6	3	4	4	1	2	4	8	8	3	51.0
Jeremy Point	5.5	5	6	5	6	6	7	8	6	7	2	63.5
New Island	0	0	1	2	0	0	0	1	0	2	1	7.0
Total Pairs	85.5	77	74	85	86	87	85	82	99	85	68	927.5

Note:

¹For years where numbers were not reported, pairs may have been included in Race Point South²May include pairs that nested at High Head, Armstrong, Exit 9, Tasha's Area, or Mission Bell³For years where numbers were not reported, pairs may have been included in Race Point South⁴For years where numbers were not reported, pairs may have been included in Race Point South or High Head⁵May include pairs that nested at Armstrong or Head of the Meadow⁶For years where numbers were not reported, pairs may have been included in Head of the Meadow⁷May include pairs that nested at Dead Forest

Table C-3. Numbers of Piping Plover Fledged and Productivity Rate By Site, Cape Cod National Seashore, 2004–2014

(The top number in each box represents the number of fledges produced while the bottom number represent the productivity [chicks fledged/pair])												
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
Herring Cove/Wood End/Long Point	7 (1.00)	12 (1.30)	11 (2.20)	23 (2.30)	8 (0.73)	6 (0.67)	18 (2.57)	25 (2.80)	3 (0.21)	6 (0.66)	1 (0.11)	120 (1.18)
Hatches Harbor	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3 (1.50)	4 (4.00)	3 (1.50)	0 (0.00)	0 (0.00)	0 (0.00)	10 (0.48)
Race Point North	23 (1.92)	13 (1.18)	18 (1.30)	23 (1.77)	30 (2.73)	3 (0.33)	17 (1.89)	6 (0.75)	0 (0.00)	1 (0.17)	2 (0.29)	136 (1.27)
Old Harbor¹	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3 (1.50)	3 (1.50)	1 (0.50)	0 (0.00)	0 (0.00)	0 (0.00)	7 (0.88)
Race Point South²	22 (1.38)	18 (1.06)	11 (1.00)	16 (1.33)	33 (2.54)	2 (0.67)	1 (0.20)	10 (2.00)	0 (0.00)	0 (0.00)	5 (1.25)	118 (1.31)
Exit 9³	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	6 (0.86)	22 (2.75)	3 (0.50)	0 (0.00)	0 (0.00)	0 (0.00)	31 (1.07)
Armstrong⁴	0 (0.00)	0 (0.00)	6 (1.20)	5 (1.00)	11 (0.69)							
High Head⁵	14 (1.40)	2 (0.33)	11 (1.40)	12 (1.20)	10 (1.67)	4 (0.40)	18 (2.00)	5 (0.56)	0 (0.00)	4 (0.80)	1 (0.33)	81 (0.98)
Dead Forest⁶	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)							
Head of the Meadow⁷	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.33)	7 (1.75)	3 (0.75)	0 (0.00)	0 (0.00)	0 (0.00)	11 (0.48)
Coast Guard (Truro)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (1.00)	1 (1.00)	0 (0.00)	3 (1.50)	1 (0.33)	6 (0.55)
Longnook	0 (0.00)	4 (4.00)	0 (0.00)	2 (1.00)	3 (3.00)	9 (1.50)						
Ballston Beach	2 (0.50)	2 (0.67)	7 (2.30)	2 (0.67)	0 (0.00)	5 (0.67)	13 (2.60)	16 (2.67)	1 (0.11)	11 (1.38)	5 (0.63)	64 (1.23)
Coast Guard (Eastham)	14 (1.40)	23 (2.30)	29 (2.07)	31 (2.07)	19 (1.12)	12 (1.71)	2 (0.25)	0 (0.00)	5 (1.00)	3 (0.75)	8 (2.00)	146 (1.49)
Nauset Light	0 (0.00)	0 (0.00)	2 (2.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.67)
Marconi Beach		1 (1.00)	2 (2.00)	0 (0.00)	7 (3.50)	3 (0.60)	5 (0.83)	8 (1.60)	4 (0.40)	8 (0.80)	12 (1.71)	50 (1.04)
Marconi Station	5 (1.25)	2 (1.00)	4 (2.00)	2 (0.67)	7 (2.33)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	N/A	20 (1.11)
LeCount Hollow	2 (2.00)	2 (2.00)	2 (2.00)	1 (1.00)	0 (0.00)	1 (0.50)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	8 (0.80)

Table C-3. Numbers of Piping Plover Fledged and Productivity Rate By Site, Cape Cod National Seashore, 2004–2014

(The top number in each box represents the number of fledges produced while the bottom number represent the productivity [chicks fledged/pair])												
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
White Crest	5 (5.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (1.00)	0 (0.00)	2 (2.00)	0 (0.00)	0 (0.00)	8 (1.00)
Cahoon Hollow	7 (2.3)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 N/A	7 (0.88)
Newcomb Hollow	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3 (1.50)	0 (0.00)	4 (1.33)	0 (0.00)	0 (0.00)	7 (0.47)
Bound Brook	4 (4.00)	0 (0.00)	4 (4.00)	13 (3.25)	5 (2.50)	0 (0.00)	3 (1.50)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	29 (1.93)
Duck Harbor	4 (4.00)	2 (1.00)	5 (2.50)	6 (3.00)	16 (2.29)	7 (1.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.50)	41 (1.21)
Great Island	15 (1.90)	6 (1.00)	9 (3.00)	6 (1.50)	10 (2.50)	0 (0.00)	2 (1.00)	3 (0.75)	5 (0.63)	2 (0.25)	8 (2.67)	66 (0.13)
Jeremy Point	0 (0.00)	4 (0.80)	4 (0.67)	8 (1.60)	13 (2.17)	4 (0.67)	17 (2.43)	2 (0.25)	6 (1.00)	0 (0.00)	0 (0.00)	58 (0.91)
New Island	0 (0.00)	0 (0.00)	3 (3.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3 (0.43)
Total No. of Chicks Fledged (Productivity [chicks fledged/pair])	124 (1.45)	87 (1.13)	122 (1.65)	143 (1.68)	158 (1.84)	60 (0.70)	137 (1.61)	90 (1.10)	30 (0.30)	46 (0.54)	52 (0.76)	1,049 (1.13)

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Note:

¹For years where numbers were not reported, pairs may have been included in Race Point South

²May include pairs that nested at High Head, Armstrong, Exit 9, Tasha's Area, or Mission Bell

³For years where numbers were not reported, pairs may have been included in Race Point South

⁴For years where numbers were not reported, pairs may have been included in Race Point South or High Head

⁵May include pairs that nested at Armstrong

⁶For years where numbers were not reported, pairs may have been included in Head of the Meadow

⁷May include pairs that nested at Dead Forest

(a) In 2002 and 2003, the number of chicks fledged and productivity for Bound Brook and Duck Harbor were reported as one site. Therefore in 2002, in this table, the number of fledges (9) and productivity (2.25 chicks fledged/pair) was split equally into each site; therefore, fledged equaled 4.5 and productivity equaled 1.125 chicks fledged/pair at each site. In 2003, the number of chicks fledged (4) and productivity (1.00 chicks fledged/pair) was again split equally between the two sites; therefore fledged chicks equaled 2 and productivity equaled 0.50 chicks fledged/pair at each site.

(b) In 2002, fledges and productivity for Nauset and Marconi were reported as one site, with no distinction between Marconi Beach and Marconi Station. For this table, the number of chicks fledged (2) and productivity (0.29 chicks fledged/pair) were reported as Nauset Light.

(c) In 2002, the number of chicks fledged (6) and productivity (0.32 chicks fledged/pair) for Great Island and Jeremy Point was reported as one site. For this table, the number of chicks fledged and productivity were split equally for 3 chicks fledged and with productivity of 0.16 chicks fledged/pair at each site.

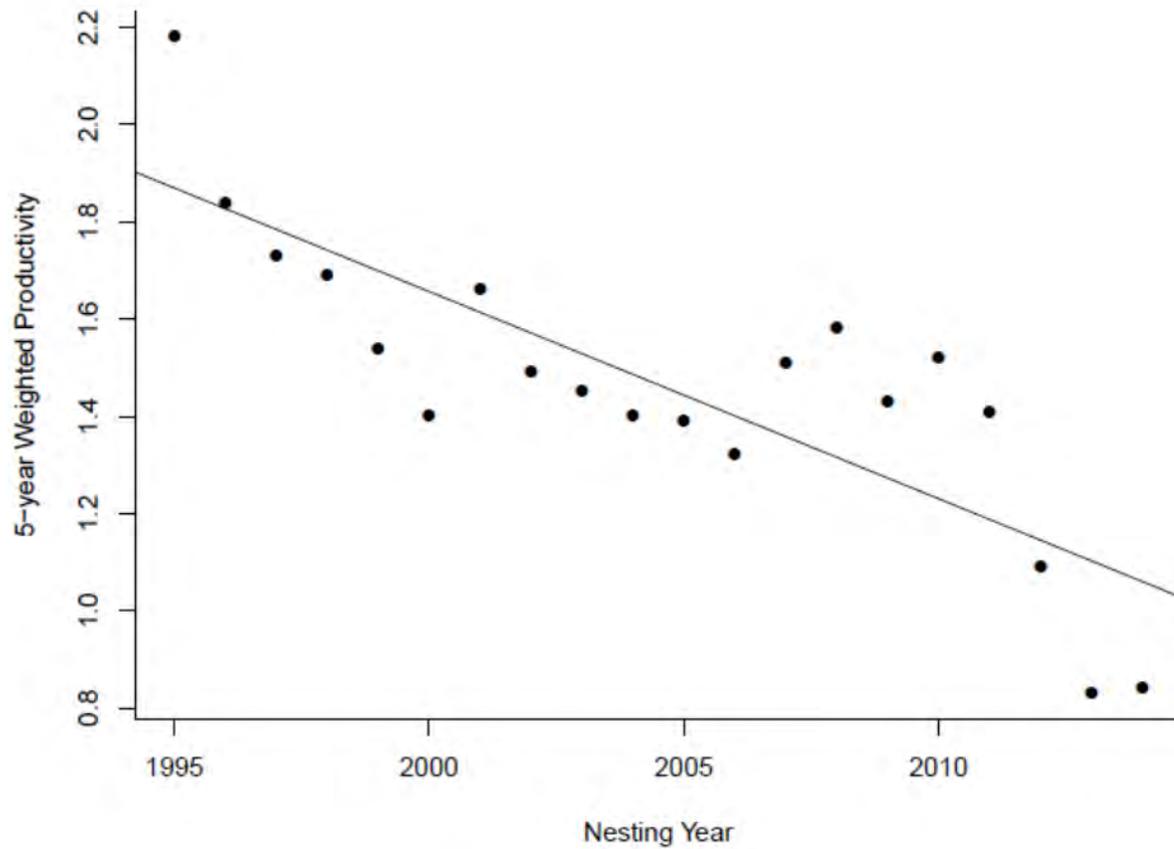


Figure C-2. Piping plover (*Charadrius melodus*) five-year productivity regression, Cape Cod National Seashore, 1995-2014 ($y = -0.0426x + 86.8899$)

ROSEATE TERN

Roseate terns are medium sized terns (33–41 cm in length, 95–130 g in weight) and are colonial waterbirds (MADFW 2007a). They feed over shallow shoals, sandbars, inlets or schools of predatory fish to benefit from the smaller prey that comes to the surface. Roseates feed on small fish (sand lance makes up 70% of their diet) and crustaceans, at times up to 30 km from the breeding colony (MADFW 2007a). The Northwest Atlantic population of roseate terns nests with common terns, forming subcolonies within larger common tern colonies (MADFW 2007a). Between 1999 and 2001, the national seashore supported three to four nesting pairs on New Island, Orleans, MA. Roseates first nested at New Island in 1999 when close to 2,200 pairs of common terns nested on this small island. In 2001, when common terns failed to use New Island as a nesting site, so did the roseate terns.

Birds depart from breeding colonies in mid-July and August and concentrate in “staging areas” around Cape Cod and the Islands before departing for the wintering grounds in South America in September (MADFW 2007a). During staging, roseate terns will display large within-season and between-year differences in the types of coastal habitats they use (USFWS 2010) as they will use marshes, intertidal mudflats, and adjacent beach habitats (Trull et al. 1999; USFWS 2010).

In spite of intensive management efforts at major colony sites and lack of a known major change in either adult survival or productivity, roseate terns have declined more than 25% in the last 10 years and the population is estimated to be ~3,100 pairs, down from its peak in 2000 of ~4,300 pairs (USFWS 2010). This information suggests a decrease in the post-fledging to first-breeding survival, overwinter survival, and/or recruitment of young adults into the breeding population. The post-breeding dispersal period, just prior to fall migration, is an especially sensitive time for many species of terns because parental care can continue well into fall migration, and even after arrival at their wintering areas (Ashmole and Tovar 1968; Feare 2002; Nisbet 1976). At fledging, young terns usually have not achieved adult mass, and several studies have demonstrated that post-fledging parental care given prior to departure from their breeding colony sites provides for an increase in mass and later post-fledging survival probability (Feare 2002; Steinen and Brenninkmeijer 2002; Schaubroth and Becker 2008). During the post-breeding dispersal period, young terns start to transition to independence, learning skills needed to fish independently, and increasing body condition and strength of flight muscles needed for the 7,000 km migration to South America. Much of the presumed recent reduction in post-fledging to first-breeding survival likely results from events that take place during this period (Spendelov et al. 2002).

Thousands of migrating shorebirds, including roseate terns, congregate on the mudflats and beaches of Nauset Marsh/Coast Guard Beach in Eastham, Jeremy Point, Race Point North and Race Point South, and Hatches Harbor to feed and rest from mid-July through October. At the time, Trull et al. (1999) proposed that at least half of the entire Northwest Atlantic population was concentrated around Cape Cod and were vulnerable to disturbance by human pedestrians (11 of 20 sites), dogs (6 of 20), beach vehicles (6 of 20), or aircraft (2 of 20). Since 2007, J. Spindelov (unpublished data), Blake (2010), and Jedrey et al. 2010; and Massachusetts Audubon Society (unpublished data) furthered Trull et al. (1999) work with intensive observations throughout the same area. Among 54 sites visited on a regular basis in one or more years, 12 sites supported >1,000 terns, with a high percentage of roseate terns on a regular basis (figure 2 in chapter 3). These sites had a total area of only 12 km² at low tide and there was regular disturbance by human pedestrians, dogs, motor vehicles and/or aircraft. Observations of a single flock at Wood End estimated 7,500 individual roseate terns were present (63% of birds in Northwest Atlantic population of breeding adults and fledglings [best estimate by Massachusetts Audubon and J. Spindelov based on data provided in NHESP 2011 report]). Observations of two other single flocks at national seashore sites between

2007 and 2011 estimated more than 6,000 roseate terns were present (Massachusetts Audubon unpublished data). In addition, from roseate tern banding data, resightings of banded chicks from the Country Island, Nova Scotia breeding site showed that 93% of all fledglings migrate from that site to national seashore (Jedrey et al. 2010).

Observations indicate that different sites are used by large groups of terns during different years, and that there is great variation in site use within seasons. Massachusetts Audubon has been conducting intensive surveys of roseate terns since 2007 (table C-4). In 2008 and 2009, researchers from Massachusetts Audubon, Antioch University New England, and the US Geological Survey reaffirmed the importance of national seashore beaches for terns during fall migration. These studies indicate that more than 90% of the entire Northwest Atlantic breeding population of roseate terns and their fledglings use national seashore beaches from mid-July through October (J. Spendelow and E. Jedrey, pers. comm. 2011).

From July through mid-September, 2,000 to over 20,000 terns were counted at Hatches Harbor, Race Point, Coast Guard/Nauset Marsh, Wood End and South Beach/Monomoy (table C-4). Roseate and common terns were the most abundant species observed. On August 1, 2009, a total of 2,500 terns were observed at Hatches Harbor, with an estimated 30% of the flock being roseate terns. From resighting data, it is evident that individual fledglings and adults use national seashore beaches for over 40 days within a season (E. Jedrey, pers. comm. 2011). Approximately 25,000 common and roseate terns were recorded at Coast Guard Beach (Eastham) in 2008 (table C-4). In 2011, at Wood End, 10,000 roseate and common terns were observed on September 18 and 1,000 roseate and common terns were observed on October 9 (E. Jedrey, pers. comm. 2011).

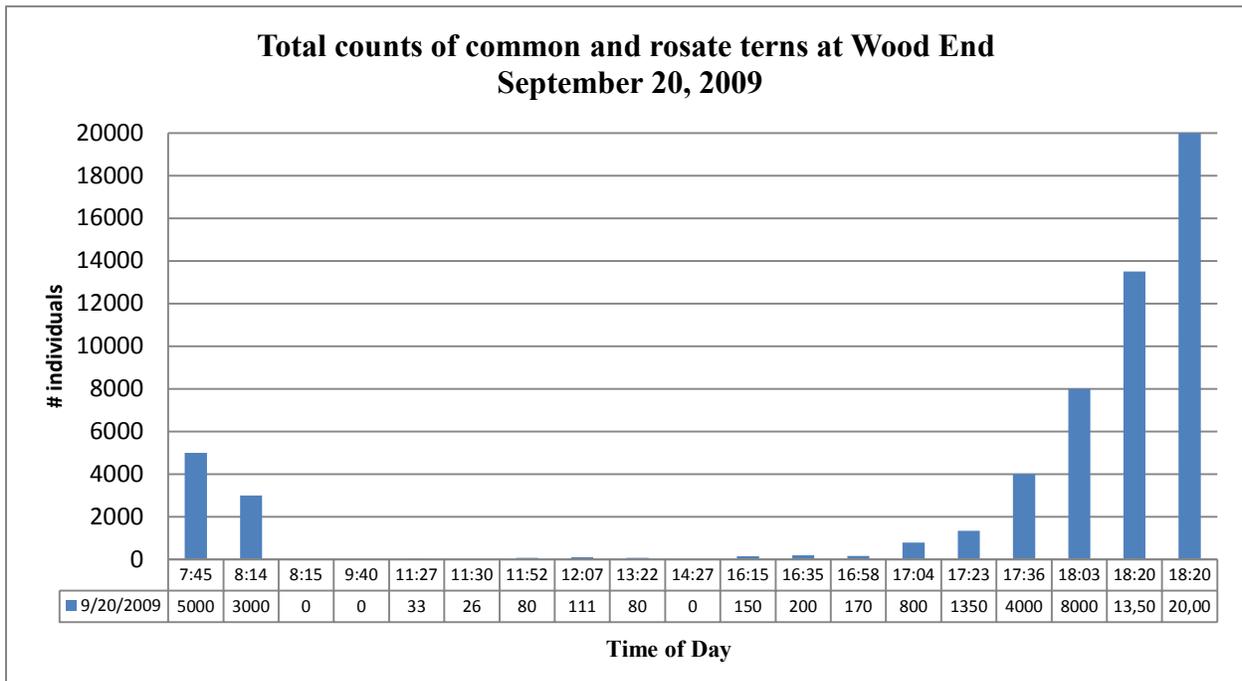
Table C-4. Largest Flocks of Tern Species Recorded By Massachusetts Audubon During Individual Observation Periods within Cape Cod National Seashore, 2007–2009

Year		
2007	2008	2009
1,200 (5%)	25,000 (30%)	19,000 (30%)
1,120 (15%)	13,500 (10%–20%)	12,000 (up to 50%)
820 (7%)	13,500 (>10%)	12,000 (10-30%)
650 (1.5%)	12,000 (no estimate)	5,500 (26%)
465 (15%)	11,000 (>11%)	5,250 (3.3%)
350 (75%)	10,000 (no estimate)	5,000 (no estimate)
	8,000 (25%–39%)	4,500 (12%)
	8,000 (5%–10%)	4,500 (7%)
	8,000 (no estimate)	4,500 (no estimate)
	7,500 (no estimate)	4,000 (50%)

Parentheses = percent roseate tern estimate of tern flock

(Total numbers of birds are noted with percent roseate tern for each flock. Flock counts result from the following effort made during Massachusetts Audubon's roseate tern resighting study: 2007—12 hours of observation over 6 days; 2008—497.5 hours over 121 days; 2009—507.5 hours over 108 days [Massachusetts Audubon unpublished data])

The USGS (J. Spendelow) and Massachusetts Audubon (E. Jedrey) made counts of common and roseate terns on Wood End/Long Point for approximately two days in September 2009 for 11 hours (continuous) each day. The area counted was approximately 1 km² total. On both days, 30% roseate terns were estimated in the highest counts for the flocks (11,500 on September 19; 20,000, on September 20) were observed. Estimates of the total number of roseate terns were 3,450 on September 19 and 6,000 individuals on September 20. In 2009, the best overall estimate for the breeding population and newly fledged chicks was approximately 12,000 individuals (6,000 and 6,000, respectively). Thus, on these two dates, 29% and 50% of the entire breeding population plus newly fledged chicks were observed at Wood End. The data collected by Massachusetts Audubon demonstrate that use of a site can vary four orders of magnitude (0–19,000 birds) within a 12-hour observation period that may have management implications (figure C-3).



(Source: Figure provided by Massachusetts Audubon unpublished data 2012)

Figure C-3. Comparison of Total Counts of Terns Over the Course of 11 Hours on September 20, 2009, at Wood End, Provincetown, Massachusetts

The national seashore has also conducted surveys of roseates over the last few years (table C-5), although surveys in earlier years were much less intensive. From 2010–2014, between mid-July and the end of September, shorebird staff at national seashore and visiting researchers observed thousands of terns (predominately common and roseate) from Coast Guard in Eastham/Nauset Marsh north to Hatches Harbor including: Marconi Beach, Jeremy Point, Head of the Meadow, High Head, Race Point South (including Armstrong and Exit 9), Race Point North, and Wood End/Long Point (table C-5). In mixed-species flocks observed during this time period, where individual species were tallied, up to 35% of terns were roseate terns and a considerable number of them were banded. In 2014, the highest percentage of roseate terns (within mixed flocks) in the North District was observed at Hatches Harbor and Race Point North, and in the South District at Nauset Marsh and Jeremy Point. Of note in 2010, was a dramatic decrease in the number of staging terns on

Race Point North after the beach was reopened to vehicles. In addition to collecting data on flock size, composition, and movement, Seashore staff documented disturbances to staging and migrating shorebirds from dogs, pedestrians, oversand vehicles, and boats.

It is not known whether adult and/or juvenile terns that are displaced from one site to another due to disturbance events are incurring a cost that will reduce their fitness for migration and successful overwintering. A more detailed, national seashore funded, three-year study on the importance of national seashore to staging roseate terns begin in 2014. This study will further investigate the geographic and temporal variation in use of staging sites by roseate terns within the park, quantify the rates and types of disturbances that staging terns face at national seashore, and document any effects that disturbances might have on roseate tern behavior. Data collected will have significant and immediate management implications, including recommendations regarding appropriate size of buffer zones and timing of recreational and pet restrictions on staging areas at the national seashore.

Table C-5. Number of Immature and Post-Breeding Roseate Terns Observed During Cape Cod National Seashore Staff Surveys, 2002–2014

Year	Immature and Post-Breeding Adults	Notes
2002	N/A	N/A
2003	75	Mid-August, mudflats of Nauset Marsh
2004	120/200	Early August mudflats of Nauset Marsh/Race Point South
2005	50	Early August mudflats of Nauset Marsh
2006	100/10-50	Mid to late August, mid-July, mudflats of Nauset Marsh/ late July through August, Jeremy Point
2007	100/10-50/5-20	Mid to late August, mudflats of Nauset Marsh/ late July through August, Jeremy Point/late July through August, mixed flocks, Race Point North and Hatches Harbor
2008	N/A	See Massachusetts Audubon Survey (table C-4)
2009	N/A	See Massachusetts Audubon Survey (table C-4)
2010	14,000/1,000/2,000	Over a 12-day period from August to September, Truro and Provincetown and Head of the Meadow to Long Point (mixed terns, over 50% at Hatches Harbor)/ Jeremy Point on September 1 (roseate and common terns) / Coast Guard Beach in Eastham on September 2 (roseate and common terns)
2011	5,000, 3,500, 450/800 and 1,000/3,000	(Mixed common and roseate terns) Nauset Marsh and Coast Guard in Eastham on September 14, 19, and 30/Jeremy Point on September 14 and 30/ Hatches Harbor on October 3
2012	3,500, 2,000, 675/400/85	(Mixed common and roseate terns) Hatches Harbor, Wood End, High Head on September 4/Race Point North on October 12/Race Point North October 22
2013	3,500/1,500/7,500/6,000/5,000-7,000/600/345	(Mixed common and roseate terns) Race Point South (Armstrong) on August 19/Hatches Harbor on August 27/High Head on August 21/Race Point North on August 25/Coast Guard in Eastham and Nauset Marsh on July 31, August 5, and August 21/ Marconi Beach on August 22/ Jeremy Point on August 30

Table C-5. Number of Immature and Post-Breeding Roseate Terns Observed During Cape Cod National Seashore Staff Surveys, 2002–2014

Year	Immature and Post-Breeding Adults	Notes
2014	1,000/600-3,000/1000/1,000/550/300/600/10,000-12,000/500/4,000	(Mixed common and roseate terns) Hatches Harbor on July 6 and September 16/Race Point North on July 31, August 17, September 17 and October 15/ Marconi Station on August 5/Cahoon Hollow and Newcomb Hollow August 6/Ballston Beach on August 11/Jeremy Point August 21/North Beach Chatham on August 30/Coast Guard, Eastham on September 6/Nauset Marsh on September 8

N/A = Information that is not currently available

In 2014, from the beginning of July through mid-October in 2014, researchers and park staff conducted surveys of staging terns and shorebirds throughout the park. Hundreds of terns (predominately common and roseate) were observed at Race Point South (Armstrong and Exit 9 area) and Jeremy Point throughout the post-breeding season, and thousands were observed at Hatches Harbor, Race Point North, Head of the Meadow, Coast Guard in Eastham/Nauset Marsh, Marconi Beach, and North Beach in Chatham. Notable counts include: 1,000 at Hatches Harbor on July 6; 2,000–3,000 at Race Point North on July 31 and August 17; 1,000 at Marconi Station on August 5; 4,000 in Nauset Marsh on September 8; and 10,000–12,000 at North Beach, Chatham on August 30. In addition to collecting data on flock size, composition, and movement, Seashore staff and researchers documented disturbances to staging and migrating shorebirds from dogs, pedestrians, oversand vehicles, and boats.

RED KNOT

There are five subspecies of red knots currently recognized (*Calidris canutus canutus*, *C.c. rufa*, *C.c. islandica*, *C.c. rogersi*, *C.c. roselaari*), with two of these subspecies (*C.c. rufa* and *C.c. roselaari*) found in the United States during migration and in the winter (Harrington 2001). The *rufa* subspecies of red knot is a shorebird that breeds in the Canadian Arctic and is known to migrate through national seashore, coastal Massachusetts and the entire eastern seaboard of the United States during the spring and fall (Harrington 2001). In 2005, in response to an 80% decline in red knot populations over the past 10 years, conservation groups filed an emergency petition asking the USFWS to list the red knot as an endangered species under the Endangered Species Act. The US Fish and Wildlife Service announced that the red knot was a candidate species for listing in 2006. The red knot was listed as a threatened species under the Endangered Species Act in December of 2014, with habitat designation currently being propose and evaluated by the US Fish and Wildlife Service.

Red knots are among the largest of the small sandpipers at about 9 inches in length and are known for their 9,300-mile migration from the Canadian Arctic to the Tierra del Fuego region of Chile and Argentina in South America, making it one of the longest-distance migrants (USFWS 2005). Red knots feed primarily on horseshoe crab (*Limulus polyphemus*) eggs during their spring migration north, stopping at the Delaware Bay (Tsipoura and Burger 1999; Baker et al. 2004), but they also feed on mollusks, crustaceans, marine worms, small snails, amphipods, and polychaete worms found in the intertidal zone and wrackline (Zwarts and Blomert 1992; Dekinga and Piersma 1993; Gonzalez et al. 1996; Harrington et al. 1986; Prater 1972; Piersma et al. 1993).

Red knot breeding habitat is the tundra and wetlands of the Canadian Arctic (Cramp and Simmons 1983; Harrington 1996, 2001). Wintering habitat consists of intertidal areas, typically along open coastlines and large bays, in Argentina, Chile and Brazil (Harrington 1996, 2001). The Atlantic coast of the United States provides migratory habitat for the red knots as they travel the immense distance between their breeding and wintering grounds. The coastal habitats at the mouths of bays and estuaries are the preferred migratory habitat, as they provide sandy beaches for foraging (Harrington 1996, 2001). Although these habitats are generally high wave energy (Harrington et al. 1986; Vooren and Chiaradia 1990; Blanco et al. 1992), red knots also use tidal flats in more low energy, sheltered bays or lagoons (Harrington et al. 1986; Harrington 1996, 2001; Tsipoura and Burger 1999). In the northeast United States (New Jersey to Maine), important red knot staging occurs mainly along New Jersey, New York, and Massachusetts coastlines. In Massachusetts, red knots use sandy beaches and tidal mudflats during fall migration near Scituate, Duxbury and Plymouth Beach, and along the shoreline of Cape Cod south to Monomoy (Niles et al. 2010).

The two main areas on Cape Cod that have been most important during fall migration in recent years are North Pleasant Bay (encompassing beach and flats from Sampson Island down to the south end of North Beach Island) and South Pleasant Bay (encompassing beach and flats of South Beach and Monomoy Refuge), including sections of beach within national seashore boundaries. The national seashore provides essential staging and foraging habitat for red knots, which can be found in the greatest numbers during fall migration (mid-July through October), using sandy ocean beaches and tidal mudflats to feed and rest. When red knots are observed, data on location, flock size, composition, and movement, are recorded. Table C-6 is a sampling of observations from Stephanie Koch, wildlife biologist, USFWS, Eastern Massachusetts NWR Complex, MA.

Table C-6. Counts of Red Knots on Cape Cod, 2008–2010

High Count	Month	Year	Locations
500+	July	2008	South Beach
500	July/August	2008	North Beach, Tern Island, flats
1000	August	2009	South Beach
700	Early August	2010	North Pleasant Bay
400	Mid-August	2010	North Pleasant Bay
350	Late October	2010	South Pleasant Bay

Historically, the greatest concentrations of red knots within the national seashore have been observed at Coast Guard Beach in Eastham and in Nauset Marsh, although from 2012–2014, hundreds have been seen along the ocean beach in Truro (Armstrong area) and Provincetown (table C-7). On August 3, 2000, 360 red knots were observed on Coast Guard Beach in Eastham (Hadden 2001). A flock of between 100 and 120 were regularly observed at Coast Guard Beach in 2014 (table C-7). In 2014, as part of a long term study to identify important migration stop-over sites throughout Cape Cod and on their wintering grounds, scientists from the US Fish and Wildlife Service captured five red knots, 11 sanderlings, three black-bellied plovers, one short-billed dowitcher, and one semipalmated sandpiper at the southern tip of Coast Guard Beach in Eastham on September 22, and affixed tracking devices to all five red knots.

Table C-7. Counts of Red Knots at Cape Cod National Seashore, 2012–2014

High Count	Date	Location
100-200	8/14/2012-8/22/2012	Armstrong (part of Race Point South)
326	8/18/2013	Nauset Marsh and Pleasant Bay
295	8/19/2013	Nauset Marsh and Pleasant Bay
175	8/21/2013	Nauset Marsh and Pleasant Bay
116	8/22/2013	Nauset Marsh and Pleasant Bay
200	8/22/2013	Between Armstrong (part of Race Point South) and Head of the Meadow
50	8/25/2013	Nauset Marsh and Pleasant Bay
185	9/6/2013	Nauset Marsh
140	9/15/2013	Nauset Marsh
5-25-19	7/31/2014-8/19/2014-8/21/2014	Armstrong (part of Race Point South)
111-49	8/16/2014-9/13/2014	Coast Guard Eastham
8-59	7/29/2014-8/17/2014	High Head
36	9/9/2014	Race Point Lifeguarded Beach
25-36	8/25/2014-8/26/2014	Race Point North
39	9/13/2014	Race Point South

Red knots are vulnerable to degradation of resources that they depend on during each phase of their life cycle. Vulnerabilities defined by Morrison et al. (2004) include: a tendency to concentrate in a limited number of locations during migration and on the wintering grounds so that deleterious changes can impact a large proportion of the population at once, a limited reproductive output in conjunction with a long lifespan resulting in slow recovery from population declines, a migration schedule closely timed to seasonally abundant food resources (such as horseshoe crab eggs) limiting flexibility in migration routes or schedule, and lastly the use of coastal habitats that are affected by a variety of human activities. Threats to red knots at national seashore can be caused by natural and human-made factors, including habitat degradation, predation, contaminants and human disturbances including: walking through resting/feeding areas, sunbathing/picnicking, leashed/unleashed pets, vehicles, fishing, boats/kayaks, aerial activities (hand-held kites, kite surfing, and remote control planes).

STATE LISTED SPECIES AND OTHER SPECIES OF CONCERN

LEAST TERN

Least terns are the smallest of all the North American terns (23 cm in length, 40–62 g in weight) and are colonial waterbirds (MADFW 2008c). Least terns arrive to the breeding grounds the first week of May. They begin forming small colonies in late May and are often within existing piping plover nesting areas. Colonies can range from a few pairs to 2,000 pairs, but are usually greater than 25 pairs (MADFW 2008c). Least terns often band together to drive away potential predators, including humans, by diving and defecating on intruders.

Eggs are commonly laid in clutches of two from mid to late May with most birds on eggs by mid-June. However, egg-laying can occur through mid-August. Both the male and female will incubate (but not equally) the nest for 21–23 days (MADFW 2008c). The chicks are semi-precocial. One to two days after hatching chicks may roam up to 200 m from the nest site, but can move up to one km if disturbed (MADFW 2008c). Generally least terns will produce one brood per season. If eggs or chicks are lost early in the season, least terns reneest up to three times (MADFW 2008c).

The chicks are fed small fish (approximately two fish/hour) by the adults through fledging. The chicks fledge in about three weeks. After the young have fledged, adults and young from several nests associate with each other (nurseries) for feeding, loafing, and roosting. Fledglings follow parents to feeding areas, where they are fed by parents as long as eight weeks after fledging and eventually begin to forage for themselves. Young birds disperse from colony sites about three weeks after fledging (MADFW 2008c). Before migrating in late August and early September, adults with fledglings may remain within the coastal breeding habitat for six to eight weeks.

Nesting habitat for least terns consists of bare sandy areas or areas sparsely vegetated above the spring high tide line. They forage over flats and in shallow nearshore waters on an array of invertebrates and slim-bodied fish within 15 cm of the water's surface (Carreker 1985; Thompson et al. 1997).

In 2014, least terns returned to the lower Cape, including national seashore beaches, during the second week of May. The first least tern was observed on May 10 at Coast Guard, Eastham. Egg laying began on May 30, with most least terns on eggs by early June. Renesting attempts continued through the beginning of August in 2014. Approximately 39 pairs had nests during the “A” count and 77 pairs had nests during the “B” count. There were a total of 11 nesting colonies from Eastham to Provincetown (table C-9).

Colony sizes fluctuated throughout the 2014 season but most were relatively small with fewer than 30 pairs. Wood End/Long Point supported the largest colony during the census windows with 29 nesting pairs. To be consistent between districts and to minimize double counting pairs that may have moved after losing a nest, dates around 6/9 for the A count and dates around 7/7 for the B count were chosen. Armstrong had a high count of 36 nesting pairs on 7/18 but this count was not included in table C-9 because it was taken outside of the defined census windows. Most colonies were depredated and multiple nesting attempts occurred throughout the season. On July 13–14, wind driven high tides overwashed the entire Wood End/Long Point colony and 22 nests were lost. There were smaller nesting colonies at Coast Guard, Eastham, Marconi Beach, Great Island, Jeremy Point, Ballston Beach, Head of the Meadow, Race Point South (including: Old Harbor and Armstrong), and Race Point North; these beaches supported a range of 1 to 29 nesting pairs.

The first least tern chicks hatched on June 28, 2014, at Wood End and the last chicks hatched on August 21, 2014, at Armstrong. Least terns are considered fledged when they are observed in sustained flight for at least 15 meters. Of the 77 pairs of nesting least terns, only seven chicks fledged (0.09 chicks/pair) from national seashore beaches in 2014: Coast Guard, Eastham (1), Great Island (2), Head of the Meadow (1), Old Harbor (1), Race Point North (1), and Wood End/Long Point (1).

In the mid-1970s to 1980s, the population of nesting least terns at national seashore generally ranged from 200–600 pairs. Over the past 10 years (2005–2014) at the national seashore, the least tern population has fluctuated between a high of 268 pairs in 2011 and a low of 77 pairs in 2014. In 2014, the population of nesting least terns within the national seashore declined by nearly half compared to 2013 (77 and 136, respectively). Because least terns are relatively long-lived, the effect of poor productivity on population status is delayed. Thus, annual reproductive success is just as critical an indicator of least tern’s population stability, as annual numbers of individuals counted (Thompson et al 1997).

Table C-8 reflects the NPS best estimate of the least tern nesting and productivity at the national seashore from 2002 to 2014, while table C-9 represents A and B least tern counts. Least tern colonies ideally are visited multiple times during the A-count window, and maximum estimates are reported. The “B-count” (or “post-peak” count) is conducted after June 20. A B-count for least terns is not necessary unless there is a significant change in numbers from the A-count, or a site that was not used during the A-period window was used after June 20. Because least terns frequently shift among sites in response to disturbance, B-counts do not contribute to the overall census numbers (to avoid double-counting the same birds); however, the B-count does document use of the site (Mostello 2010).

Table C-8. Total Number of Nesting Pairs and Productivity of Least Terns at Cape Cod National Seashore, 2002–2014

Year	Number of Nesting Pairs	Number of Chicks Fledged	Estimated Productivity (chicks fledged/pair)	Primary Cause of Loss
2002	316	1 chick from 153 pairs in SD	Relatively productive in ND	Coyote, skunk and gulls
2003	371	≥22	0.059	Overwash, Canid, Skunk
2004	270	24	0.089	Overwash, Canid, Skunk
2005	162	5 chicks from 49 pairs in ND	good in the SD	Overwash and Canid
2006	112	6-11	0.05 – 0.10 (estimated)	Canid
2007	86	35-45	0.45 (estimated)	Overwash and Canid
2008	136	-	Less than 1 chick/pair	Overwash and Coyotes
2009	236	25	0.11	Overwash and Coyotes
2010	226	26	0.12	Coyotes
2011	268	99	0.37	Coyotes
2012	257	66	0.26	Coyotes
2013	138	2	0.01	Coyotes
2014	77	7	0.09	Overwash and Coyotes

Note: In other years, predators have also included crows, gulls, opossum, raccoon, red fox and black-crowned night herons (see in 2003). Where canid was listed, it was likely coyote. (ND = North District, SD = South District).

Table C-9. Number of Least Terns Breeding Pairs By Site, Cape Cod National Seashore, 2002–14

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Herring Cove/Wood End/Long Pt.	84	41	7 (10)	32	2 (0)	6 (-)	4 (11)	15 (5)	5 (22)	19 (56)	14 (36)	1 (1)	3 (29)
Hatches Harbor											0 (0)	0 (0)	
Mission Bell ¹			11 (11)		3 (7)	24 (0)	10 (14)	Na		5 (2)	0 (5)	6 (0)	
Tasha's Area ² /Armstrong ⁶			12 (12)		0 (-)	0 (-)	0 (-)	Na		0 (1)	0 (1)	0 (3)	0 (11)
Race Point North (also referred to as Race Point Light Area)	35	44	6 (11)	11	3 (-)	6 (-)	12 (42)	25 (26)	16 (16)	41 (40) (d)	15 (29)	29 (18)	5 (17)
Old Harbor (also referred to as Race Point Coast Guard Station) ³			0 (6)		3 (8)	36 (-)	0 (-)	Na				1 (0)	8 (1)
Race Point South ⁴	28	21		14			0 (5)	41 (28)	7 (28)	8 (13)	2 (7)	0 (0)	
Exit 9 ⁵									7 (34)	6 (8)	0 (4)	0 (0)	
High Head ⁷	16	19	0 (5)	4	0 (-)	0 (-)	18 (5)	19 (32)	3 (17)		0 (0)	0 (5)	0 (0)
Head of the Meadow					0 (-)	0 (-)	0 (-)	1 (13)	88 (19)	3 (8)	12 (50)	29 (0)	0 (3)
Ballston Beach	0		0 (10)	0	1 (12)	0 (-)	0 (-)	7 (-)		0 (10)	0 (13)	0 (4)	7 (5)
Coast Guard (Eastham)	13	110	73 (64)	260	50 (16)	12 (6)	12 (-)	69 (-)	10 (22)	11 (30)	34 (34)	46 (38)	1 (6)
Nauset Light/Marconi	16 (a)			0									
Marconi Beach		8		0	0 (-)	0 (-)	0 (4)	1 (19)	1 (36)	13 (23)	34 (15)	8 (21)	2 (4)
Marconi Station/LeCount Hollow			48 (33)	19 (c)	0 (-)	12 (19)	13 (-)	33 (-)			0 (0)	0 (0)	
Cahoon Hollow			44 (18)	20	0 (-)	0 (-)	0 (-)	0 (-)			0 (0)	0 (0)	
Duck Harbor				0							0 (0)	0 (0)	
Great Island/Jeremy Point	124	128	36 (-)	20(b)	24 (-)	14 (20)	32 (20)	32 (24)	32 (32)(b)	0 (5)/24 (72)	40 (63)	2 (20)/16 (1)	13 (1)
New Island	0			0	0 (5)	0 (-)	0 (-)	0 (-)			0 (0)	0 (0)	
Total Pairs	316	371	237 (A) 180 (B)	380	86 (A) 48 (B)	110 (A) 45 (B)	101 (A) 101 (B)	243 (A) 147 (B)	169 (A) 226 (B)	130 (A) 268 (B)	151 (A) 257 (B)	138 (A) 111 (B)	39 (A) 77 (B)

Note: (-) indicates no B count

¹For years where numbers were not reported, pairs may have been included in Race Point South

² For years where numbers were not reported, pairs may have been included in Race Point South

³For years where numbers were not reported, pairs may have been included in Race Point South

⁴May include pairs that nested at Armstrong/Tasha's Area, Old Harbor, Exit 9, or High Head

⁵ For years where numbers were not reported, pairs may have been included in Race Point South

⁶ For years where numbers were not reported, pairs may have been included in Race Point South or High Head

⁷May include pairs that nested at Armstrong

(a) In 2002, Nauset and Marconi were reported as one site, with no distinction between Marconi Beach and Marconi Station

(b) In 2005 and 2010, this data was reported only as "Jeremy Point"

(c) In 2005, 10 pairs were recorded for Marconi Station and 9 pairs for LeCount Hollow

(d) Includes Old Harbor

Na = information that is not currently available

Least tern productivity throughout the national seashore has varied over the past 10 years, but has generally been poor, with less than one chick fledged/pair. The low productivity of least terns is due to intense predation on eggs and chicks, mainly by coyotes. In addition, the narrowing of beaches and increased frequency of late spring/summer storms make nesting areas more vulnerable to wash-overs.

Field observations in 2014 suggest that most tern colonies at the national seashore were visited almost daily by coyotes, most often resulting in a loss of nests or chicks. Coyotes seem to be attracted to tern colonies due to the concentration and abundance of eggs and can develop a search pattern that is highly effective in locating ground nesting bird nests in open habitat. Coyotes may also be attracted to the scent of garbage, food waste and food storage, and food cooking associated with human recreation near tern colonies. Fish remains left on the beach by fishermen during the nesting season may also attract coyotes to these beaches. While predator sign at a nest bowl can indicate the cause of nest loss, it is more difficult to identify predators of least tern chicks once they hatch, but it is likely that the same species (mainly coyotes) preying on eggs are also preying on chicks.

The colonial nesting strategy used by terns and other seabirds evolved as a means of protecting eggs and chicks of the colonial species by a collective defensive effort by the adults in the colony. Adult members of the colony react as a group to any predator (or perceived threat) that comes in close proximity to the colony and use mobbing behavior to deter the intruder. However, the colonial nesting strategy is ineffective with very small colonies, because an insufficient number of adults are available to mob and deter the predator. The typical size of a single colony of colonial nesting seabirds such as terns can range from the thousands to tens of thousands of individuals. The colony sizes of nesting least terns at the national seashore have decreased over the years and continuous disturbance by predators fragments and disperses existing colonies, further hindering the ability of the colony to defend itself. In addition, a high predation rate, which drives down colony size, makes the birds even more vulnerable to further predation, and likely a major contributor to the plummeting reproductive success of least terns at the national seashore.

AMERICAN OYSTERCATCHER

American oystercatchers are large shorebirds (41–46 cm in length, 396–680 g in weight) (NPS 2010a) that reside on coastal islands and salt marshes throughout the year (Schulte et al. 2010; Nol et al. 2000). American oystercatchers return to their breeding ground by the end of March to nest. Three eggs (rarely two or four eggs) are laid by late April, early May in a shallow scrape and are incubated by both adults for about 24–28 days. American oystercatchers may re-nest if eggs or nestlings are lost early in the season. Chicks remain in the nest for 1–2 days and then move with adults within their nesting territory or into nearby foraging areas which can be 50 to 200 meters (approximately 150 to 600 feet) away, depending on the habitat. Chicks are precocial and typically take 35 days to fledge (Nol and Humphrey 1994). At national seashore, fledging has extended to up to 45 days. Most of the local breeding American oystercatchers begin to migrate away from the nesting grounds by mid to late August. On Monomoy Island, Massachusetts, American oystercatcher numbers in staging flocks peak in late August and early September (Schulte and Brown 2003).

American oystercatchers nest on flat, sandy or rocky beaches above the high tide line, with sparse to no vegetation. American oystercatchers will also build nests on marsh islands, and dredge spoil islands (Nol and Humphrey 1994; McGowan et al. 2005). At national seashore nests have historically been located on distal tips of narrow barrier spits (Jeremy Point and the southern end of Coast Guard Beach in Eastham) and on New Island, Orleans. American oystercatchers feed on marine invertebrates (bivalves, mollusks, marine worms) from sand or rocky beaches, salt marshes, or

intertidal mud flats (Nol and Humphrey 1994). Because of their specialized diet, adult American oystercatchers must open shellfish and feed their young almost entirely until 60 days old (Palmer, 1967; Nol and Humphrey 1994).

At national seashore, from 2002 through 2014, American oystercatcher pairs have ranged from two to five nesting pairs at Jeremy Point, Coast Guard Beach (Eastham), and New Island, Orleans with productivity of 0.34 chicks fledged/pair (table C-10). American oystercatchers were first recorded nesting on national seashore beaches in 2002, with two pairs at Jeremy Point and one pair at Coast Guard Beach (Eastham). All three pairs were unsuccessful in fledging any chicks. From 2003 through 2005, the number decreased to two pairs, both at Jeremy Point, but most eggs were lost to predation or overwash. In 2006, the number of nesting pairs doubled to four, including one nest at New Island, Orleans. Productivity improved, with one chick fledging from Jeremy Point and one from New Island. The number of nesting pairs increased to five pairs in 2007 and 2008; and with productivity of 0.6 and 1.0 chicks fledged/pair, respectively. From 2009 to 2014 there have been two to three pairs, although not all pairs laid nests.

Other American oystercatchers nest and roost on national seashore property on South Beach, within the town of Chatham, but is cooperatively managed by Chatham. South Beach and has been identified as an important breeding area for 7–10 pairs of American oystercatchers. Nauset Marsh in Eastham is an important staging area for American oystercatchers. In 2009, sightings of 22 and 20 staging American oystercatchers were documented by the National Park Service in the Nauset Marsh Complex (B. Walsh, pers. comm. 2009). The west side of South Beach in combination with the island of Monomoy National Wildlife Refuge has been identified as one of the largest staging areas in the Northeast for American oystercatchers where up to 215 birds use the site (Schulte et al. 2010).

COMMON TERN

Common terns are medium sized terns (38 cm in length, 110–145 g in weight) and the most familiar and widespread tern of North America. These colonial waterbirds return to the breeding grounds in early May and begin forming small colonies in late May. Common terns nest in colonies of a few birds to thousands of pairs. It often breeds in colonies with roseate and Arctic terns, black skimmers (*Rynchops niger*), but seldom with least terns (MADFW 2007b).

Nests are composed of two to three eggs that are laid by mid to late May/early June with most birds on nests by mid-June. Nests are incubated by both sexes for approximately 23 days. If nests are lost, birds will reneest through mid-August (MADFW 2007b). The semi-precocial chicks are present by the first week in July. The young generally fledge in 22 to 29 days. Chicks are dependent on the adults for food and will continue to be fed by their parents until dispersal from the breeding site. Starting in mid-July through mid-August, common terns begin congregating in large groups in “staging areas” around Cape Cod to forage before their southern migration. The parents and young will stay together through staging (MADFW 2007b). Flocks of common terns will linger along national seashore until mid-October.

Common terns nest on sand or gravel islands and beaches with scattered vegetation. Common terns feed on small fish (primarily sand lance), crustaceans, and insects by diving into the water (MADFW 2007b). During staging, common terns will feed at inlets and likely offshore and rest on undisturbed beaches and sand flats near tidal inlets.

**Table C-10. Number of Breeding Pairs and Annual Productivity of American Oystercatchers
at Cape Cod National Seashore, 2002–2014**

Year	No. of Pairs	No. of Nests	No. of Nests Hatched	Chicks Fledged	Productivity (chicks fledged/pair)	Cause of Nest or Chick loss
2002	3	3	1	0	0	Unknown Predator (2 nests); Unknown (chick loss)
2003	2	3	0	0	0	Unknown predator (2 nests); Canid <i>spp.</i> (1 nest)
2004	2	3	1	0	0	Overwash (1 nest); Unknown predator (1 nest, and chick loss)
2005	2	5	0	0	0	Overwash (3 nests); Sanded over (1 nest); Infertile (1 nest)
2006	4	4	4	2	0.5	Unknown (chick loss)
2007	5	7	3	3	0.6	Overwash (1 nest); Unknown predator (3 nests); Unknown (chick loss)
2008	5	6	5	5	1.0	Unknown predator (1 nest); Crow (1 nest); Unknown (chick loss)
2009	2	1	1	0	0	Unknown predator (chick loss)
2010	2	5	1	0	0	Coyote (4 nests); Unknown (chick loss)
2011	2	5	2	0	0	Coyote (3 nests and chick loss); Unknown (chick loss)
2012	3	6	2	0	0	Coyote (4 nests); Unknown (chick loss)
2013	3	10	0	0	0	Coyote (4 nests); Overwash (4 nests); Unknown (2 nests)
2014	2	4	2	0	0	Coyote (3 nests); Unknown (chick loss)
Total	37	62	22	10	0.27	—

In 1999, 2,176 pairs of common terns nested on New Island, but numbers sharply declined by over 50% in both 2000 and 2001 (1,078 and 495, pairs, respectively) and productivity was low due to intense egg predation from coyotes, gulls, crows, and skunks. Ants have also preyed on chicks as they emerge from their eggs. In 2002, it was the first year in over 20 years that no common terns nested on New Island, but 112 pairs did nest on Coast Guard Beach in Eastham, which was likely the birds relocating from New Island. Unfortunately all those nests were also preyed by gull, skunk, and perhaps coyote. In 2008, one pair nested on New Island and nine pairs nested in 2009. All nests were lost to predation. More recently, a few common terns were observed circling New Island in 2010, but no birds nested. In 2011, three pairs of common terns nested unsuccessfully on New Island and one pair nested within a least tern colony on the southern tip of Jeremy Point. In 2012–2013, one or two pairs nested unsuccessfully on New Island each year. In 2014, no pairs nested on New Island, or anywhere else in the national seashore.

Although the number of nesting common terns on the national seashore has declined in recent years, the national seashore continues to provide essential staging habitat for these birds during fall migration (table C-5). In late summer, thousands of migrating shorebirds, including common terns, congregate on the mudflats and beaches throughout the park including Nauset Marsh/Coast Guard Beach in Eastham, Jeremy Point, Race Point North, Race Point South and Hatches Harbor to feed and rest. These areas are some of the most important staging and roosting areas for terns and other shorebirds on Cape Cod (Trull et al. 1999; Hadden 2001). In 2008 and 2009, researchers from Massachusetts Audubon, Antioch University New England, and the US Geological Survey reaffirmed the importance of national seashore beaches for terns during fall migration. From July through mid-September, 2,000 to over 20,000 terns (refer to table C-4) were counted at Hatches Harbor, Race Point, Nauset Marsh/Coast Guard in Eastham, and South Beach/Monomoy Beaches with common and roseate terns as the most abundant species observed. The national seashore has also conducted surveys for common terns, although previous years were not as intensive (table C-5). In 2010, from late August through early September, surveys of staging terns and shorebirds were conducted by national seashore shorebird staff on the beaches of Truro and Provincetown, from Head of the Meadow to Long Point. Over 14,000 terns were estimated in these areas over the 12-day period, and over half of these were observed in Hatches Harbor. Although five species of terns were identified, the majority were common and roseate terns (table C-5). There was a dramatic decrease in the number of staging terns on Race Point North after the beach was reopened to vehicles. In the South District, beginning in the middle of July, hundreds of mixed-species (common and roseate) terns were regularly seen congregating on the tidal flats at Coast Guard Beach in Eastham, Marconi Beach, and Jeremy Point (table C-5). From the beginning of July through mid-October in 2014, researchers conducted surveys of staging terns and shorebirds throughout the park. Hundreds of terns (predominately common and roseate) were observed at Armstrong, Exit 9, Race Point South and Jeremy Point throughout the post-breeding season, and thousands were observed at Hatches Harbor, Race Point North, Head of the Meadow, Coast Guard in Eastham/Nauset Marsh, Marconi Beach, and North Beach in Chatham (table C-5). The highest percentage of roseate terns (within mixed flocks) in the North District was observed at Hatches Harbor and Race Point North, and in the South District at Nauset Marsh and Jeremy Point.

ARCTIC TERN

Arctic terns are medium sized terns (40 cm in length) and colonial waterbirds known for their circumpolar migration. Arctic terns return to their breeding grounds in mid-May and lay one to two eggs in or by June. Arctic terns form colonies from several to tens of thousands of pairs and are found with common and least terns. Birds incubate their eggs for approximately 21 days and the semi-precocial chicks fledge in 21–24 days, usually by early August. Chicks are dependent on the

adults for food (MADFW 2008b). The Arctic tern is very defensive in the colony and dive bomb intruders. Arctic terns nest on rocky islands and beaches and feed on small fish, crustaceans, and insects (Hatch 2002). If the nest is lost, Arctic terns do not re-nest. Arctic terns feed by diving into the water and feed primarily on small fish (sand lance), crustaceans, and invertebrates (MADFW 2008b).

A few Arctic terns historically nested at the national seashore. Three pairs nested on New Island in Orleans from the late 1970s to 2001 (Trull pers. comm. 2009). More recently, one pair nested on Coast Guard Beach in Eastham from 2003 to 2005. Since then, no Arctic terns have nested at the national seashore. All nests at the national seashore were lost to predation (skunk, coyote, gull) and not a single fledgling has been observed.

THREATS TO SHOREBIRDS

Threats to the federally and state listed species and species of concern (as previously discussed in this chapter) can be caused by natural and human-made factors including loss of habitat/ habitat degradation, flooding, predation, contaminants, human disturbance from pets, vehicles, and recreational activities (MADFW 2007a, 2007b, 2008a, 2008b). Emerging threats also include alternative energy development and climate change. As discussed in the Piping Plover Recovery Plan (USFWS 1996) and in the Piping Plover Five-Year Review (USFWS 2009a), threats to piping plovers include loss of habitat, flooding by tides or storms, disturbance due to humans, vehicles, and pets, predation, contaminants, wind turbines and climate change (Patterson et al. 1991; Melvin et al. 1994; Watts and Bradshaw 1995; Loegering et al. 1995; Murphy et al. 2003; Cohen et al. 2009; Zonick 2000; Zdravkovic and Durkin 2011; Koch and Paton 2013). Competition with other species, such as displacement by gulls can affect tern species (Kress 1983; MADFW 2007a,b; USFWS 1998, 2010). As discussed in the Roseate Tern Five-Year Review (USFWS 2010) erosion, habitat degradation, climate change, changes in coastal morphology, human disturbance, predation, contaminants, and wind turbines are current threats to Northwest Atlantic roseate terns. Recreational activities affecting shorebirds include pedestrian and vehicular activities (Hoopes et al. 1992; Goldin 1993), kites (Hoopes et al. 1992), boats (Burger 1998), increasing predators, which is thought to be largely linked to human activity (USFWS 1996; McGowan and Simon 2006), and leashed and unleashed pets (Hoopes et al. 1992). As discussed in Cohen et al. 2010 for American oystercatchers, known nest failures (< 49% of nesting attempts) are caused by mammalian predation (60%), flooding (25%), avian predation (5%), abandonment (5%, possibly another cause), humans (3%), vehicles (< 2%), and ghost crabs (< 2%) (Simons et al. 2004). Migrating red knots are also threatened by a decline in the availability of horseshoe crab eggs, particularly in Delaware Bay horseshoe crabs have been harvested for bait for the conch and eel fisheries and biomedical use (Niles et al. 2010).

Several natural and human-made factors pose threats national seashore beach-dependent species. Natural factors can include habitat loss from storms, flooding, and erosion, and predation. Human related factors include disturbance from pets, vehicles, and recreation as well as unbalanced levels of predation. The ocean beach and bayside habitats used by nesting and roosting shorebirds at national seashore are highly desired for human recreation. Unless properly managed, these activities can disturb and displace shorebirds and negatively affect their breeding and migratory success, survival rates, population size, and long term viability.

PETS

Shorebirds are extremely vulnerable to disturbance and predation by pets, even when leashed. Pets, especially dogs, chase, harass and kill nesting shorebirds, break or eat their eggs and chicks as well as disturb roosting, feeding, and staging shorebirds (Hoopes 1993; Lord et al. 2001; Weston and Elgar 2007). A study conducted on Cape Cod found that piping plovers were disturbed by pets at an average of 46 meters (151 feet) versus disturbance from humans at an average of 23 meters (75 feet). Plovers reacted to pets by moving farther away from pets than humans, 57 meters (187 feet) vs. 25 meters (82 feet) respectively (USFWS 1996). American oystercatchers are more often found in areas not disturbed by domestic dogs and cats (Nol and Humphrey 1994). Dogs may keep adults from incubating their eggs or brooding chicks, exposing them to extreme temperatures or weather and predators. Pet activity also reduces shorebird abundance (Burger 1981) and those birds that remain must spend more energy on vigilance and escape at the expense of foraging and rest (Pfister et al. 1992; Burger 1993, 1994b).

Despite this prohibition, since at least 2002, dogs off-leash continues to be a chronic issue at the national seashore during breeding, feeding and migration season. In 2003, a total of 295 dogs off-leash were observed with 234 dogs in the South District and 61 dogs in the North District. In 2004, (332 dogs), 2005 (331 dogs), 2006 (307 dogs), 2007 (245 dogs), 2008 (279 dogs), 2009 (506 dogs), 2010, (446 dogs), 2011 (401 dogs) and in 2012, a total of 543 dogs were recorded off-leash. More recently, in 2013, a total of 490 dogs were observed off leash on the national seashore (239 in the South District and 251 in the North District); unleashed dogs were encountered most frequently at Newcomb Hollow (68), Coast Guard in Truro, (40), Lecount Hollow (37), and Hatches Harbor (35). In 2014, a total of 97 written warnings for pet violations were issued (47 in South District, and 49 in North District) and 61 violation notices (54 in South District, and 8 in North District) were issued. Shorebird monitoring staff recorded a total of 597 dogs off leash on national seashore beaches from April 16 through September 8 (303 in the South District and 294 in the North District). Unleashed dogs were encountered most frequently at Newcomb Hollow (64), Coast Guard in Truro, (48), Lecount Hollow (64), and Herring Cove/Wood End (74) (table 1). Dogs were also observed by shorebird staff on multiple occasions within areas seasonally closed to pets at Coast Guard in Eastham, Jeremy Point, and Hatches Harbor.

OFF-ROAD VEHICLES

Off-road vehicles (ORVs) can crush plover eggs and chicks. Unless managed, ORVs can degrade piping plover habitat (Wheeler 1979) or disrupt the birds' normal behavior patterns (Zonick 2000). They may harm or harass plovers by crushing wrack into the sand and making it unavailable as cover or a foraging substrate (Godfrey et al. 1978; Hoopes et al. 1992; Goldin 1993), by creating ruts that can trap or hinder movements of chicks (Jacobs 1988), and by preventing plovers from using habitat that is otherwise suitable (MacIvor 1990; Strauss 1990; Hoopes et al. 1992; Goldin 1993; Hoopes 1994). ORVs can cause a decrease in brood foraging behavior (Hoopes 1993; Burger 1994b). Similar impacts have also been noted for other beach dependent species such as terns (Blodgett and Melvin 1996) and American oystercatchers (McGowan 2004). Vehicles that drive too close to the toe of the dune may destroy 'open vegetation' that may also furnish important piping plover habitat (Elias-Gerken 1994). Repeated shorebird disturbance by vehicles can dramatically affect the long term use of areas as staging or resting areas. Zonick (2000) found that the density ORVs negatively correlated with abundance of roosting piping plovers on the ocean beach. The potential threat from ORVs is particularly significant, because vehicles extend impacts to remote stretches of beach where human disturbance would otherwise be very slight.

Forgues (2010) examined ORV effects to migrating shorebirds at Assateague Island National Seashore in Maryland and Virginia (it should be noted that ORVs here tend to access the beach, drive a short distance, and park with recreation occurring around the parked vehicle). Generally, the ORV effects varied by species and by season where some species exhibited season-long sensitivity and others were more sensitive in the fall season. Whimbrels maintained an approximately 250-foot distance from approaching ORVs. The number of species and abundance of the five shorebird species researched declined with higher ORV presence along with the size and number of roosting areas; there was an increase in available food, however due to the decreased foraging at these sites. On undisturbed beaches where shorebird foraging was concentrated, the available forage was depleted. Migrating shorebirds spent less time foraging and were excluded from prime food sources when ORVs/recreationists were present which likely results in reduced energetic and demographic consequences to migrating shorebird fitness (Forgues 2010). Shorebird behavior also changed in areas with ORV use in that less time was spent foraging and more time was spent resting and shorebirds avoided areas where ORVs were present. Forgues (2010) concluded that shorebirds may be able to tolerate ORVs if the use levels are not highly concentrated; however because shorebird

species vary in sensitivity to disturbance, some species may be affected by low levels of ORV use, as well.

HUMAN DISTURBANCE

The presence of humans disrupts shorebirds during territory establishment, courting, and egg-laying (Erwin et al. 1981). Human activity prevents plover chicks from foraging, separate chicks from adults, increase chicks' vulnerability to predation, and cause thermal stress (Weston and Elgar 2007; Burger 1991; USFWS 2009a). Young plover chicks are reactive to human disturbance and observations of chicks running away from humans are common. Additionally, when humans are present in feeding areas, chicks are often forced to feed in suboptimal habitat. Burger (1994b) found that time devoted to vigilance (when they are not searching for food) is positively related to the number of people near them, and the overall human use of that habitat. Burger also suggests that in habitat with fewer people, plovers spend 90% of their foraging time actively searching for prey and feeding, whereas on beaches with many people they may spend less than 50% of their foraging time in direct feeding behaviors. On narrow beaches with high human visitation, the lack of dry beach, especially at high tide, forces the beachgoer and nesting birds to come in close contact with each other, increasing the frequency and probability of human disturbance or the chance of accidentally stepping on a young chick.

Colonial nesting birds are particularly susceptible to human disturbance during courtship and territorial establishment because of high nest density; when one bird is disturbed enough to respond, others often follow (Rodgers and Smith 1995). Stationary human activity such as picnicking, sunbathing or camping too close to nesting terns keep the birds agitated and away from their nests (Blodget and Melvin 1996). In addition to interfering with behaviors that defend the colony from predation, persistent human disturbance can also cause colony abandonment.

As discussed in Cohen et al. 2010 and NPS 2010a, in areas of high disturbance by humans and vehicles, lower nest survival and greater loss of chicks has occurred for nesting American oystercatchers (McGowan 2004; Sabine 2005). American oystercatchers need large, undisturbed beach areas for successful nesting, which frequently exposes them to human disturbance (disturbance from pedestrians, vehicles, and unleashed pets) and can cause the abandonment of nest habitat as well as direct loss of eggs and chicks (Meyers 2005). American oystercatchers will react to perceived threats approximately 200 meters to 300 meters from their nests or young, and disturbance within 150 meters can reduce incubation of eggs and foraging for young (Verboven et al. 2001; Sabine 2005). These studies indicate American oystercatchers require a buffer distance of up to 200 meters (656 feet) from their nesting areas (Cohen et al. 2010).

Post-breeding terns at tern staging areas may be impacted by a variety of human-related activities such as beach walking, dog walking, kiteboarding, clamming, and boating, among others (Massachusetts Audubon 2008; NPS pers. obs.). Disturbance as a result of these activities may cause birds to take flight, and may affect energetics, feeding of young, cohesion of family groups, survival of young, and ability of sites to support staging terns (MADFW 2011).

In 2008, the Massachusetts Audubon conducted 618.5 hours of observation and observed 308 disturbance events to common and roseate tern flocks including dogs, humans, kiteboards, boat, helicopters and planes, boats (including kayaks), vehicles, observer, wildlife/habitat-related and questionable. Overall rates of disturbance ranged from 0.10–0.89 disturbances/hour with known causes. The highest rate of disturbance was recorded at Hatches Harbor (0.89 disturbances/hour); other sites with high levels of disturbance included Nauset Marsh, Black Beach/Sippewisset Marsh,

and Coast Guard Beach in Eastham. The lowest levels of disturbance were observed at Minimoy Island and Jeremy Point, both of which were 0.10 disturbance/hour (Massachusetts Audubon 2008 unpublished data). In 2009, during tern counts, researchers from Massachusetts Audubon and the USGS recorded a variety of disturbances negatively impacting shorebirds, including roseate and common terns. During 32 days of observation, disturbances were recorded on 14 days (43%); of these disturbance days, seven of them (50%) included at least one disturbance caused by a leashed or unleashed dog. When the flocks of terns were disturbed by dogs, part or all of the flock vacated the area and did not return during the observation period. On nice weather days and weekends, 50 cars or more (maximum count of 100 vehicles counted on August 4, 2009) were observed on the outer beach at Hatches Harbor at national seashore. The majority of human and dog disturbance occurred in and around the bayside intertidal flats after vehicles began to arrive on the beach. In addition, this area was a popular spot for dog owners to play fetch with their unleashed dogs (E. Jedrey, pers. comm. 2009). The new threat of human disturbance at fall staging sites deserves further investigation. It is not known whether flocks of terns that are temporarily displaced from one site to another due to disturbance, incur an energetic cost that will reduce their fitness for migration and successful over wintering (USFWS 2010).

Koch and Paton (2013) determined flight initiation distances for 11 species of foraging migratory shorebirds at Monomoy National Wildlife Refuge relative to pedestrian traffic and shell fishing. Both species and age of birds affected the flight initiation distance; juveniles had a shorter distance than adults, allowing pedestrians to approach more closely. Of the species recorded, sandpipers exhibited shorter flight initiation distances (approximately 80 feet) and American oystercatchers longer distances (approximately 160 feet). The shorebirds tended to run prior to flying, from approximately 20 feet up to 110 feet. Koch and Paton (2013) recommended buffers from pedestrians and those shell-fishing for staging/migrating shorebirds of 200–320 feet for the smaller shorebirds including least sandpipers and 370–610 feet for the larger red knots and American oystercatchers; for flocks of mixed species the larger buffer was recommended. Shellfish harvesters raking clams on mudflats where shorebirds actively foraged had positive effects to the American oystercatcher density; some shorebirds actively foraged in sediments recently exposed by those shell-fishing (Koch and Paton 2013).

In 2014, within the national seashore, footprints left by beach-goers inside the closed and posted shorebird nesting area at Coast Guard Beach in Eastham were recorded in proximity to a newly hatched least tern chick (figure C-4). Similarly, in figure C-5, a visitor to Marconi Beach was observed walking inside the closed and posted shorebird nesting area of a least tern colony and stepped within 1.0 meter of a nest with eggs.



Figure C-4. Newly-hatched least tern chick (circled) amidst bare footprints from beach-goers inside the closed, posted shorebird nesting area at a colony site at Coast Guard Beach in Eastham, Cape Cod National Seashore, 2014.



Figure C-5. Footprints from a visitor who was observed walking inside the closed, posted shorebird nesting area at a least tern colony at Marconi Beach, Cape Cod National Seashore, 2014. The visitor came within one meter of stepping on a least tern nest (circled).

AERIAL RECREATIONAL ACTIVITIES

Aerial recreational activities such as remote control planes, kite flying and kiteboarding/kitesurfing and para/hang gliding are types of disturbance that can negatively impact shorebirds. When kites are flown in or near nesting habitat, plovers exhibit the same behaviors as when avian predators are present (Hoopes et al. 1992). The use and launching of these different types of kites can cause birds to shift or abandon breeding territories, flush incubating birds off nests, cause nest abandonment, disturb feeding adults or chicks, or physically harm eggs or unfledged chicks. Kiteboarding/kitesurfing can have a direct conflict with ecological functions and disturbs and displaces birds (Beauchamp 2009). Smith (2004) notes that kite surfers are a major source of bird disturbance and that kite surfers disturb the near shore areas where terns and other birds feed on shoals and sand eels. Kite boarding/surfing has been identified as an emerging threat for piping plovers (USFWS 2009a), but impact other shorebirds in a similar manner. In addition, at national seashore, paragliders flying above least tern nesting areas cause terns to take flight, exposing eggs and chicks to predators and adverse weather conditions (Hake, pers. comm. 2014).

In experiments on birds with different aerial disturbances, it was found that escape flight reactions are the natural response to all flying objects. Remote-controlled model aircraft resulted in a marked frightening effect on almost all groups of birds (Kempf and Huppopp 1998). It is above all, the irregular changes of volume and frequency that play an important part in the disturbance effect. Like kites, these low flying objects are likely mistaken for avian predators. Impacts to nesting birds can include nest abandonment and disruptions in feeding in both adults and chicks and increase vulnerability to predators.

BOATING

Boat landings on the beach can cause disturbance to feeding plovers and other shorebirds (USFWS 1996). Boats have been known to cause disturbance to staging terns (Trull et al. 1999). Rodgers and Schwikert (2002) found buffer zones to minimize disturbance for foraging and resting from both personal watercrafts and outboard-powered vessels ranged from 100 meters for plovers and sandpipers, 140 meters for terns and gulls, and 180 meters for wading birds.

The distal tips of barrier spits have long been important sites for piping plovers and colonial nesting shorebirds. Their physical features and sparse vegetation provide high quality nesting and roosting habitat. Even more importantly, the distant ends of peninsulas provide a high degree of protection from land based predators, and because they are often distant from centers of human activity, have traditionally provided beach nesting birds with some of the least disturbed sites available. Historically, the southern tips of Coast Guard, Eastham and Jeremy Point, and the eastern tip of Wood End and Long Point have received little visitation because they were difficult to get to, requiring individuals to hike several miles in the sand. These narrow peninsulas provide important nesting and foraging habitat for piping plovers and other shorebirds. The remoteness of these areas ensured a rare sanctuary free of most human disturbances and a “wild” beach experience for adventuresome visitors.

In addition, these distal barrier spits, sand flats and tidal creeks have long been important staging/resting areas at national seashore. In recent years, these once remote sections in the park have become a popular destination for boaters. Now, on any given day in the summer and fall, it is not uncommon to see motor boats, kayaks and canoes in these areas disturbing and displacing staging/migrating shorebirds.

APPENDIX D: PREDATOR MANAGEMENT REVIEW

In selecting any wildlife management tool or method such as nonlethal or lethal techniques, consideration must be given to the predator species responsible and the frequency, extent, and magnitude of damage (USDA 2003). Methods chosen would depend on the number of individuals of a given wildlife species involved with the associated damage or threat, historic density of nesting shorebirds that have been highly impacted by predation, and the efficacy of methods employed. In order to reduce predation losses to accomplish Atlantic Coast recovery objectives (USFWS 2009a), the national seashore has identified a variety of tools from which they may choose the most appropriate method of addressing site-specific predation threats as conditions and predator populations and species change over time.

Selective, lethal removal of predators, one option considered, can greatly reduce mortality rates among piping plovers (Brady and Ingelfinger 2008; M. Pforr, pers. comm. 2010), terns (Butchko and Small 1992; Guillemette and Brousseau 2001), and American oystercatchers (Martin et al. 2010). By being selective, it is usually not necessary to remove or kill large numbers of predators, rather only the individuals causing the predation. The USFWS conservatively estimates that in areas where selective predator removal is implemented, the long-term average productivity of special status shorebird species could increase by 20% (USFWS 2010). The national seashore could also continue using nonlethal predator exclosures (as described in the no-action alternative) as an option to protect nesting plover adults and eggs from a variety of predators, but predator exclosures do not work for terns or American oystercatchers and have inherent risks. Therefore, the only practical way to reduce impacts of predation on special status species of nesting shorebirds would be local removal of individual predators that prey on adults, eggs, and chicks to help contribute to increased productivity levels.

Species currently considered for removal include the American crow and Eastern coyote. Other potential predators considered for removal may include red fox, Virginia opossum, striped skunk, feral cats, and/or gull species if they become more problematic in the future (see appendix J). An approach the national seashore could take under the preferred alternative would be to combine use of exclosures (consistent with the no-action alternative) with selective predator removal, targeting individual animals observed keying into specific nesting areas and exclosures. This approach would provide the greatest degree of protection to nests, while reducing risks to adults and chicks associated with exclosures. The 1996 USFWS Piping Plover Recovery Plan (USFWS 1996) identifies depredation as “a major limiting factor in the recovery of the species, and recommends that the local land managers utilize an integrated approach to predator management that considers the full range of management techniques, including removal of predators where warranted and feasible.” The Piping Plover Five-Year Review (USFWS 2009a) supports effective integrated predator management and the development of agreements to ensure long-term protection and management that would maintain population targets and productivity.

Predator management can include a variety of nonlethal and lethal methods (including the use of exclosures, electric fencing, trapping with euthanasia, shooting, and avicides) to alleviate excessive predation on threatened and endangered species and other species of concern and has been implemented or contracted on lands by state and federal agencies (e.g., MADFW, USFWS, NPS) and nongovernmental organizations (e.g., Duxbury Beach Reservation Inc., The Trustees of Reservations (TTOR), and The Nature Conservancy in Rhode Island).

Even though exclosures can protect nests, they have limited value due to limited utility against some predator species and do not protect other beach nesting birds, mobile piping plover chicks, or adults. Crane Beach in Ipswich, Massachusetts (TTOR), has used electric fencing (since 2002) to deter the mammalian predator Eastern coyote from foraging on piping plovers and least terns (B. DeGasperis, TTOR, pers. comm. 2012) with mixed results.

With the limitations of exclosures, electric fencing, and other nonlethal management tools, wildlife managers have increased selective predator removal activities at many sites along the Atlantic Coast to alleviate predator damage on plovers, terns, and American oystercatchers (B. Clifford, pers. comm. 2012; Cohen et al. 2009; NPS 2007c; USDA 2003, 2004, 2005, 2006, 2008, 2009a, b, 2010a,b, 2011a,c). However, several studies have also shown that the use of electric fences or predator removal programs in conjunction with nest exclosures leads to increased overall reproductive success (Lauro and Tanacredi 2002; Ivan and Murphy 2005).

The USDA APHIS-Wildlife Service manages wildlife that cause damages to private property, agricultural crops, and natural resources using a variety of nonlethal and lethal control methods. Integrated predator management for both mammal and avian predators has been implemented for several years in most coastal national park areas in the northeast that support nesting shorebirds. These programs are credited with significantly increasing piping plover nest success and chick survival.

Similar USDA environmental assessments and projects to alleviate predation on threatened and endangered species and species of concern have occurred in Massachusetts (USDA 2006, 2010a, 2011a) and other states, including Maine, New Hampshire, New Jersey, and Virginia (B. Clifford, pers. comm. 2012; USDA 2003, 2004, 2005, 2007, 2008, 2009a,b, 2010b, 2011b, 2011c). In addition, similar programs have been implemented on the NPS units of: Cape Hatteras National Seashore (North Carolina), Assateague Island National Seashore (Maryland), Cape Lookout National Seashore (North Carolina), and Gateway National Recreation Area (Sandy Hook, New Jersey and Breezy Point Unit, New York) (USDA 2003, 2004, 2005, 2009b, 2011c). The USDA APHIS-Wildlife Service would likely be selected to provide wildlife damage management assistance to carry out predator management activities at the national seashore. Reductions in the predator population(s) would be conducted using approved (discussed in alternative B) nonlethal and lethal techniques for wildlife damage management as described and evaluated by the US Department of Agriculture in Massachusetts for mammals, crows (USDA 2011a), and gulls (USDA 2010a), and specifically for the protection of beach nesting birds as described and evaluated in USDA (2011a).

Although it is difficult to predict the increase attributed to predator management on an annual basis due to confounding factors such as severe weather and high tides causing nest and/or chick loss (USDA 2006; Ingelfinger 2009b), predator management programs in New England that have been implemented for several years indicate average productivity is generally higher when selective predator management is implemented.

After red fox removal in Plymouth, Massachusetts, there was an increase in the number of shorebirds using the site (e.g., common terns increased from 13 pairs in 2005 to 641 in 2006) (USDA 2011a). Piping plover productivity increased at this site averaging 1.67 chicks fledged/pair during the three years of predator management compared with 0.86 chicks fledged/pair during the seven years prior to the program (Streeter 2009). In 2010, the USDA APHIS-Wildlife Service removed one Eastern coyote from Plymouth where a large colony of tern species, laughing gulls (*Larus atricilla*), and 19 pairs of piping plovers occurred. A necropsy was performed and 3.4 pounds (1.54 kilograms) of tern chicks were in the stomach contents. This total weight could equate to 50–100 chicks if using an estimated weight of 0.5 to 1.0 ounce (14.2 to 28.4 grams) per chick that were predated on a single

night by a single Eastern coyote and illustrates how devastating predation on these shorebird species can be (USDA 2011a).

In 2013, Biodiversity Works on Martha's Vineyard was awarded funding from USFWS for piping plover restoration for targeted predator management at Dogfish Bar and Cedar Tree Neck. In 2013, a total of 14 striped skunks and 9 American crows were captured and euthanized before the plover nesting season. A feral cat was trapped and taken to an off-island shelter. Predator removal was attributed to higher productivity of nesting shorebirds in 2013 compared to 2011 and 2012 when there was no predator removal (table D-1) (Baldwin and Johnson 2013).

TABLE D-1. PIPING PLOVER PRODUCTIVITY ON DOGFISH BAR AND CEDAR TREE NECK, MARTHA'S VINEYARD, MA, 2011–2013

Year	Dogfish Bar			Cedar Tree Neck		
	Pairs	Chicks Fledged	Productivity	Pairs	Chicks Fledged	Productivity
2011	6	1	0.17	1	0	0
2012	7	5	0.71	2	2	1.0
*2013	5	12	2.4	2	3	1.5

*Predator management program in effect

In Maine, the USDA APHIS-Wildlife Service conducted a predator management program from 2007–2013 on some beaches to address both mammalian and avian predators of piping plovers and least terns (table D-2). Productivity was higher for all years on sites that implemented selective predator management and in some years doubled productivity (A. Vashon, APHIS, unpublished data 2014).

Butchko and Small (1992) conducted mammalian and avian predator removal in California to benefit the endangered California least tern. Coyotes, raccoons, skunks, ground squirrels, ravens, crows, American kestrels (*Falco sparverius*), and loggerhead shrikes (*Lanius ludovicianus*) were preying on least tern nests and fledglings. Because other exclusion methods were unable to reduce predation to allow satisfactory productivity, predator removal was implemented. Prior to predator removal, there were 0.27 chicks fledged per breeding pair of least terns in 1987. After predator removal was initiated the number of chicks fledged ranged from 1.48 to 1.66 per pair in 1988. The number of chicks fledged increased in the early 1990s to the highest recorded number of chicks fledged (Butchko and Small 1992). A metapopulation model for the California least tern was developed to predict the persistence of the least tern population and the effects of various management actions (Akçakaya et al. 2003). The model demonstrated that the reduction of predation did increase substantially the viability of the population under the assumption of low vital rates (e.g., survival and fecundity) (USDA 2011a).

Predator management has also occurred on Rhode Island NWR Complex beaches and was effective in reducing the amount of predation of piping plover nests and eggs, with a reported increase in fledglings (Shaffer 2011); however, the long-term effects of predator management on productivity remain to be seen.

Table D-2. Piping Plover Productivity With and Without Predator Removal in Maine 2007–2013

	With Predator Removal			Without Predator Removal		
	Sites	Pairs	Chicks Fledged Per Pair	Sites	Pairs	Chicks Fledged Per Pair
2007	4	15	1.53	12	20	0.70
2008	3	12	2.25	8	13	1.15
2009	2	14	2.43	8	13	0.92
2010	7	21	1.48	4	9	2.00
2011	5	18	2.33	9	15	1.86
2012	4	19	1.79	11	23	1.30
2013	4	18	2.28	12	26	1.69
2014	5	20	2.50	13	30	1.57
Average		137	2.06		149	1.40

Gulls and crows have been removed at sites in Massachusetts and elsewhere (Brady and Ingelfinger 2008; Iaquinto et al. 2012; Ingelfinger 2009a, b; Brady 2010; Denoncour and DeGasperis 2011; Gareau 2010, 2011; Shaffer 2010, 2011; Thompson and Ingelfinger 2009; USFWS 2007b; USDA 2006, 2008, 2009b, 2010a, b). In 2008, at TTOR between mid-April and early June, from 18–36 crows were removed. Crow activity declined immediately and remained low during the rest of the season. Piping plover productivity was the highest since 1999 at 1.50 chicks fledged/pair and exceeded 1.25 chicks fledged/pair for first time since 2002 (Ingelfinger 2009a). In 2009, during the same time period (mid-April and early June), from 10–20 crows were removed (Ingelfinger 2009b) and the overall productivity was 1.28 chicks fledged/pair (Thompson and Ingelfinger 2009). In 2009, Ingelfinger (2009b) noted that after two years of the predator control program, the effort was an economical, effective, and publically tolerated approach to increasing piping plover productivity.

Between 2008 and 2010, there was a 45% increase in the number of nesting pairs of piping plovers, from 22 pairs in 2008 to 32 pairs in 2010 (Brady 2010). In 2011, 35 pairs of piping plovers nested for a 9.3% increase from the 32 pairs that nested in 2010. TTOR attributed successful nesting seasons to their comprehensive predator management program that included broad use of electric fencing, the rapid deployment of exclosures, and the targeted removal of crows (Brady and Ingelfinger 2008; Denoncour and DeGasperis 2011). In 2012, TTOR continued the crow control program at Crane Beach by entering into a cooperative agreement with USDA APHIS-Wildlife Service, to provide the methodology used in 2008–2010. Due to low crow presence on the beach overall in 2013, USDA APHIS-Wildlife Service did not implement any crow removal (T. Cozine, pers. comm. 2014).

In 1996, USDA APHIS Wildlife Service conducted a herring gull and great black-backed gull colony reduction project at the request of Monomoy National Wildlife Refuge (MNWR). The removal of the gulls resulted in an expansion of common and roseate tern nesting on South Monomoy Island (USDA 2010a). In 2010, at Duxbury Beach, the USDA APHIS Wildlife Service selectively removed crows resulting in a fourfold increase in productivity from 2009 (M. Pforr, pers. comm. 2010). Between four and six crows were removed which resulted in only one plover nest lost to a crow and 8 of the 11 first nest attempts went on to hatch (Gareau 2010). In 2011, the early season crow removal program was undertaken again and considered very successful. A group of 10–14 crows that were regularly seen near plover habitat was reduced to 2 crows. Because there was evidence that Eastern

coyote or fox were responsible for the loss of piping plover nests, four Eastern coyotes were removed by mid-June. Again in 2013, the Duxbury USDA APHIS Wildlife Service managed mammalian and avian predators for the protection of piping plovers and least terns. Although nighttime surveys were conducted and some Eastern coyote tracks were observed, only American crow management was required (USDA 2013).

Both Crane Beach and Duxbury Beach documented a secondary benefit to selective predator management. Because first nesting attempts were more successful, there was less re-nesting. Less monitoring effort was required as chicks fledged earlier in the season than in prior years. Because the plover nesting season was shorter, vehicle and other visitor use restrictions were lifted earlier in the beach season. They found the value of these secondary benefits to be significant; staff were able to accomplish additional tasks and beach managers and enforcement rangers benefited from earlier vehicle access, improving public safety and protection of natural resources through greater ranger presence and enforcement (Brady and Ingelfinger 2008).

Parker River National Wildlife Refuge, on Plum Island in Newburyport, Massachusetts, manages nesting piping plovers on approximately 6 miles of Refuge beach. The refuge contracted with USDA-APHIS from 2008 to 2010 to conduct three years of selective predator management. Following these three years of predator management, predation reached an all-time low, with zero nests being depredated and chick survival climbing to 75%. In 2011–2012, when the refuge discontinued predator management, the probability of nest depredation increased and chick survival decreased (figure D-1) (Pau 2014).

Predator management is an integral part of piping plover recovery efforts on adjacent lands to the national seashore at Monomoy National Wildlife Refuge (K. Iaquinto, USFWS, pers. comm. 2015). Avian predators (e.g., large gull species, black-crowned night-heron) and mammalian predators (e.g., Eastern coyote, Virginia opossum, striped skunk, and raccoon) have been documented as responsible for nest loss for plovers, terns (as previously discussed), and American oystercatchers. After implementing predator management on South Monomoy Island, census results from the past several years showed continued minimal nesting by gulls in this area and in some years, no lethal removal of gulls or their eggs was needed (Iaquinto et al. 2012). Eastern coyotes continue to be an issue for Monomoy National Wildlife Refuge. Table D-3 illustrates the coyote sightings and removals on the refuge, which continues to implement predator management when needed to prevent the expansion of herring gull, great black-backed gull, and laughing gull nest colonies on South Monomoy Island and to alleviate nest loss from mammalian predators (USDA 2010a; Iaquinto et al. 2012).

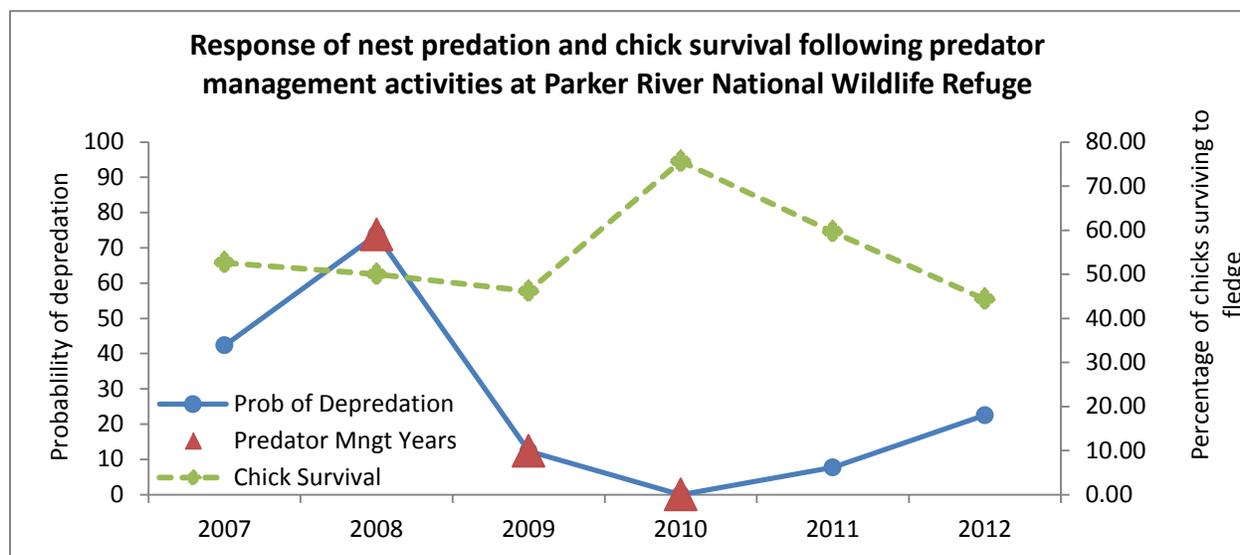


Figure D-1. A correlation between predator management and piping plover productivity at Parker River National Wildlife Refuge, Newburyport, MA. Solid line is the probability of an unexclosed nest being depredated, based on Mayfield calculations (Mayfield 1975); and the dashed line is the percentage of chicks surviving from hatching to fledgling (from Pau 2014).

TABLE D-3. EASTERN COYOTE REMOVALS ON MONOMOY NATIONAL WILDLIFE REFUGE, CHATHAM, MA, 1996–2014

Year	Records of Sightings and Removal
1996	0 coyote removed
1997	0 coyote removed; tracks and scat observed
1998	1 coyote removed (female) ; other adults, pups, and abandoned dens were observed; piping plover nests lost and evidence of coyote entering tern colony
1999	1 coyote removed (female)
2000	10 coyotes removed (2 adults males; 8 pups (4 males, 4 females))
2001	13 coyotes removed (1 adult (female), 12 pups (unknown sex))
2002	10 coyotes removed (10 pups (unknown sex))
2003	6 coyotes removed (2 adult males, 4 adult females)
2004	20 coyotes removed (17 adults (6 males, 11 females; 3 pups (unknown sex)); tracks observed on Minimoy Island
2005	5 coyotes removed (4 adult males, 1 adult female)
2006	9 coyotes removed (6 adult males, 2 adult females, 1 adult unknown sex)
2007	19 coyotes removed (15 adults (10 males, 5 females); 4 pups (3 males, 1 female))
2008	19 coyotes removed (12 adult males, 7 adult females)
2009	30 coyotes removed (26 adults (16 males, 1 female, 1 adult unknown sex); 4 pups (all male))
2010	19 coyotes removed (12 adults (6 males, 5 females, 1 adult unknown sex); 7 pups (3 males, 4 females))

TABLE D-3. EASTERN COYOTE REMOVALS ON MONOMOY NATIONAL WILDLIFE REFUGE, CHATHAM, MA, 1996–2014

Year	Records of Sightings and Removal
2011	13 coyotes removed (11 adults – 7 males, 3 females, 1 unknown sex); 2 pups (both male)
2012	14 coyotes removed (5 adult males, 2 adult females), and 7 pups (4 males, 3 females). Tracks were recorded in all areas of the refuge, and adults were frequently seen on North Monomoy Island and South Monomoy
2013	9 coyotes removed 4 adults (3 males, 1 female) and 5 pups (2 males, 3 females).
2014	6 coyotes removed (6 adults)
Total	143 Coyotes Removed

Source: K. Laquinto pers. comm. 2014 and 2015

APPENDIX E: PREDATOR SPECIES BACKGROUND

Mammalian and avian predation has been identified as a crucial contributor or primary cause in the decline of plovers, terns, and black skimmers (*Rhynchops niger*) throughout their breeding range (Patterson et al. 1991; Kain 1996; USFWS 1996 and 2009a; Erwin et al. 2001; Boettcher 2002 and 2003; Mabee and Estelle 2000). American crows have been identified as significant piping plover predators in Massachusetts (Brady 2010; Brady and Ingelfinger 2008; Denoncour and DeGasperis 2011; Gareau 2010, 2011; Ingelfinger 2009 a, b; USDA 2006), Maine (USDA 2007, 2008, 2009a, 2011b), and Assateague Island National Seashore in Maryland (NPS 2001c). As discussed in the Piping Plover Five-Year Review (USFWS 2009a), predation was found to be the main threat to piping plovers in Virginia (Boettcher et al. 2007) and avian predators (gulls and crows) were identified as major predators of piping plover eggs from actual and artificial nests at Gateway National Recreation Area in New York (Lauro and Tanacredi 2002).

Both avian and mammalian predators contributed to losses of least terns on Virginia barrier islands (Beck et al. 1990). Along the Virginia barrier islands, increases in the range of red fox and raccoons were observed with concurrent declines of terns and black skimmers (Erwin et al. 2001). Terns have abandoned former nest sites due to direct predation or nest site competition with increased numbers of gulls (Kress 1983; USFWS 1998, 2010). Terrestrial predators reduced hatching success of least terns in Massachusetts (Rimmer and Deblinger 1992) and contributed to colony failure of large mainland least tern colonies in New Jersey (Burger 1984). In Massachusetts, shorebirds are negatively impacted by predators such as Eastern coyotes and Virginia opossum and by invasive species such as feral cats and Norway rats. Predation by gray fox, raccoons, fisher, weasels, mink, striped skunks, bobcat, fish crows, and American crows have also negatively affected shorebirds at their breeding sites (USDA 2011a).

Predation has been determined to be a major cause of nest failure in every breeding study of American oystercatchers (Davis 1999; Davis et al. 2001; McGowan 2004; McGowan et al. 2005; Nol 1989; Novick 1996; Sabine et al. 2005; Schulte and Brown 2003; Wilke and Watts 2004 as cited in Schulte et al. 2010). Predators including raccoon, red fox, Eastern coyote, feral cats, bobcat, American mink, herring gull, great black-backed gull, laughing gull, American crow, fish crow, and ghost crab (*Ocypode quadrata*) were confirmed in Georgia, North Carolina, Virginia, and Massachusetts. Predation was also a major cause of mortality of American oystercatcher hatchlings (Lauro and Burger 1989) as well as in other oystercatcher species (Heg and van der Velde 2001; Hazlitt 2002). Mammal predation was responsible for more than half of nest failures of American oystercatchers in North Carolina (McGowan et al. 2005).

At the national seashore from 2005 through 2014, the leading causes of all piping plover nest loss to predation has been American crow (42% of all nests lost to predation), “unknown” predator (unable to identify species) (27%), and Eastern coyote (23%). Many of the nests lost to “unknown” predators were instances where wind and rain prevented predator identification via tracks in the sand; it is likely that “unknown” predators are the same species as known predators. In 2014, 70% of plover nest loss was due to predation, with 22% due to “unknown” predators, 16% due to Eastern coyotes, and 33% of the loss due to American crows. Predation can also increase the duration of the shorebird nesting season and cause additional energy expenditure, as shorebirds will often re-nest several times if nests are lost. In 2013, national seashore staff recorded one female piping plover that re-nested four times on Coast Guard Beach in Eastham. MacIvor (1990) documented one female piping plover that re-nested five times on Cape Cod.

Predators are a major cause of nest loss to terns at the national seashore, where in most years predator pressure is so intense that very few nests hatch, causing continuous re-nesting attempts. In 2013, two least tern chick fledged from 136 nesting pairs from 11 colonies (0.01 chicks/pair); 2014 was not much better with 7 least tern chicks fledging from 77 nesting pairs from 11 colonies (0.09 chicks/pair).

Predator tracks, predominately Eastern coyote and American crow, were observed daily throughout tern colonies with some tracks leading up to known nests.

Predators that use the habitats of the national seashore seasonally or year-around are diverse and include species of mammals and birds (NPSpecies Database 2014) as summarized below. Predator species discussed in detail in this appendix include those capable of capturing or feeding on shorebird eggs, chicks/fledglings, and adults. Direct observation and tracking indicates that the predominant predators of nesting shorebirds in the national seashore are currently the American crow, Eastern coyote, and red fox. Although no population estimates are available for these species within and near the national seashore, field observations and data collected through tracking (up to shorebird nests) suggest that local predator populations are robust and growing.

EASTERN COYOTE

Field observations at the national seashore suggest that in the early 1990s, Eastern coyote predation on nesting shorebirds was relatively low (K. Jones, pers. comm. 2009). Their impacts to nesting shorebirds rose in the late 1990s through 2003. From 2005–2014, the percentage of total piping plover nest losses due to predation, attributed to coyotes, ranged from 0% in 2006 to 40% in 2012 (table E-2) More recently, coyotes were the leading cause of nest predation in 2012 and 2013 (41 nests and 31 nests respectively; table E-2).

Eastern coyotes have likely caused the abandonment of several exclosed nests and are responsible for several adult shorebird mortalities over the years. Exclosed nests have been lost to coyotes digging under or jumping into exclosures to take eggs and chicks. Coyotes are suspected of depredate tern colonies as they seem to be attracted to the concentrations and abundance of the eggs and chicks. In most years, field observations suggested that colonies were visited daily by coyotes, most often resulting in loss of nests or chicks. Individual coyotes and/or their tracks are regularly seen throughout most (if not all), of the tern colonies at the national seashore each season. In 2013, tracks indicated that Eastern coyotes were responsible for the loss of 29 least tern nests in a 24-hour period at Head of the Meadow between June 11 and June 12.

American oystercatchers were first recorded nesting at the national seashore in 2002; since then, two to five pairs have nested each year in the South District. During these years, most nests/chicks were lost to predation (predominately Eastern coyote) or overwash. From 2006–2008, productivity was better, but still low with an average of 0.53 chicks fledged/nesting pair and from 2009 through 2014, productivity has been zero. In recent years, coyote predation has been the main cause of nest loss. Eastern coyote tracks are observed daily within oystercatcher nesting areas, with some tracks leading directly to nests.

At the Monomoy National Wildlife Refuge, preliminary data suggests that in 2014, one piping plover nest and three broods of piping plovers were lost to coyote (K. Iaquinto pers. comm. 2015). In 2013, Eastern coyotes accounted for the known loss of four piping plover nests at the refuge while eight piping plover nests were lost to coyotes in 2012 and 10 piping plover nests were lost to coyotes in 2011. In 2006, the stomach content of one Eastern coyote on the refuge contained 69 common tern

chicks in one night of feeding; in 2009 two coyote stomachs together contained 75 common tern chicks from the Monomoy National Wildlife Refuge. In 2011, the USDA APHIS Wildlife Service removed one coyote from a nesting shorebird and gull colony in Plymouth, Massachusetts. A necropsy was performed and 3.4 pounds of tern chicks were in the stomach of the coyote. This would equal 50–100 chicks if using an estimated weight of 0.5 to 1.0 ounce per chick that was predated on a single night by a single coyote and demonstrates how devastating predation on these nesting species can be (USDA 2011a).

Individual coyotes (or small groups), can develop a search pattern that is highly effective in locating ground nesting birds in open habitat and allow them to easily key into exclosed nests. Coyotes may be attracted to the smells of garbage, food storage, and food cooking associated with human recreation. The increased number of fish remains left on the beach by fishermen during the nesting season may also encourage coyote use of these beaches, keying into exclosed nests.

Coyotes are believed to be increasing throughout their population ranges in the United States (Gese et al. 2008). Eastern coyotes are well established statewide, with the exception of Martha's Vineyard and Nantucket. In the 1930s and 1940s coyotes are thought to have reached northern New England and moved southward (Way 2001) until the 1950s, where coyotes moved into the central and western parts of Massachusetts (USDA 2011a). By the 1970s, coyotes expanded into the eastern areas of the state and Cape Cod most likely by swimming the canal and/or crossing directly over the two bridges that connect Cape Cod to the mainland (Way 2001). Coyotes then arrived on the outer Cape by the late 1980s (Trull 2002). The USDA (2011a) suggested that the statewide population could range from nearly 2,000 coyotes to a high of nearly 4,000 coyotes if coyotes occupy 50% of the land area by using density estimates from Knowlton (1972).

Knowlton (1972) claimed 0.5 to 1.0 coyotes/miles² could be applicable to coyote densities across much of their range. A coyote researcher of eastern Massachusetts estimates 200–250 coyotes are likely present on the Cape and number less than 1 coyote/mi² and 5,000 coyotes maximum statewide based on territory sizes (inclusive of transients (J. Way, Eastern Coyote Research, pers. comm. 2012). The Massachusetts Division of Fish and Wildlife most recently estimated that the coyote population (summer) is approximately 10,000 coyotes statewide, based on reported coyote densities in rural and suburban areas and extrapolated over the state (L. Conlee, pers. comm. 2014). Population trends for Massachusetts provided by Monomoy National Wildlife Refuge (2004) indicate an increasing trend in the coyote population. Although no population estimates are available for coyotes at the national seashore, field observations suggest that the population is robust and growing. Over the past several years, coyotes were regularly observed on beaches in the middle of the day and coyote tracks were commonly observed in the sand in both districts.

Most of the mammalian species, including Eastern coyotes, evaluated by the USDA APHIS Wildlife Service for the losses of nest predation, can be killed in Massachusetts during annual hunting and trapping seasons; their daily/seasonal bag and possession is an unlimited number of each species, which would suggest that coyotes are not at risk of overharvesting. The number of coyotes reported by the Massachusetts Division of Fish and Wildlife as harvested and taken by USDA APHIS Wildlife Service from 2006 through 2013 is shown in table E-1. It is voluntary to report the take of coyotes to Massachusetts Division of Fish and Wildlife, so numbers reported represent a minimum number of coyotes harvested. Coyotes can also be taken to alleviate damage and threats of damage; however, this number is currently unknown (USDA 2011a).

TABLE E-1. KNOWN TAKE OF COYOTES IN MASSACHUSETTS, 2006–2014

Year	Harvest Take ^{1,2}	WS Take ³	Total
2006	242	6	248
2007	532	11	541
2008	513	13	526
2009	599	32	631
2010	489	31	520
2011	449	27	476
2012	470	24	494
2013	N/A	14	N/A
2014	N/A	18	N/A
Total	3,294	176	3,436

¹ Harvest take includes coyotes reported is determined by pelt tagging and these numbers include animals taken through trapping, hunting, and salvaged (during the season).

²Reported by season; for example, the 2006 entry covers the hunting and trapping season that began in 2006 and ended in 2007 since the season often carry over from one calendar year to another with seasons general beginning in the fall and ending in the later winter.

³WS take is reported by federal fiscal year.

N/A = information that is not currently available.

Source: USDA 2011a; data also provided by L. Conlee pers. comm. 2014 and T. Cozine, USDA APHIS WS, pers. comm. 2014)

Annual harvest in the Southeast District of Monomoy National Wildlife Refuge (Wildlife Management Zones 12, 13, and 14) ranged from 115 to 203 since the 2007/2008 season (compared to 470 to 599 harvested annually statewide). Monomoy National Wildlife Refuge (2013) lethally removes all Eastern coyotes from April through August during the shorebird nesting season; from 1998–2012, 189 Eastern coyotes (adults and pups) were lethally removed from the Monomoy National Wildlife Refuge. The maximum number of Eastern coyotes removed annually from the refuge was 30 individuals during 2009.

AMERICAN CROW

Two species of crow breed in Massachusetts, the American crow and the fish crow (*Corvus ossifragus*). The American crow is common to abundant and uses urban and rural forested areas, fields and pastures, and coastal beaches as habitat. As discussed in USDA (2011a), crows are present year-around in Massachusetts (Robbins and Blom 1996) with an estimated statewide population of 110,000 crows based on the North American Bird Breeding Survey (BBS) data (Rich et al. 2004). The fish crow is an uncommon but increasing species in Massachusetts, where it is near the northernmost part of its range; it is nearly identical to the American crow, but is smaller and has a distinct call. Crows flock to roost sites each evening and the American crow in particular is well-known for forming large communal roosts with many to hundreds of individuals present in the nonbreeding season.

Crows are opportunistic and adaptable feeders and over the past several years, their population appears to have increased along the national seashore beaches. In 2013, on two occasions at Head of the Meadow, shorebird staff observed a crow flying into the least tern colony, taking eggs from known nests. At the national seashore, from 2005–2014, the leading cause of piping plover nest loss

to predation has been from American crow (table E-2). Data suggest that the impacts of American crows on piping plover nests (and chicks) are increasing. Direct observations of crows at the nest site eating piping plover eggs have been observed by national seashore staff. It is hypothesized that anthropogenic (human-related) factors have increased population levels of crows, causing increased mortality to piping plover and other special status species nests, chicks, and adults. From 2005–2014, American crows accounted for the greatest percentage of total piping plover nests lost to predation, 42% (table E-2).

TABLE E-2. SUMMARY OF PIPING PLOVER (*CHARADRIUS MELODUS*) NEST LOSS, AND CAUSE OF NEST LOSS, AT CAPE COD NATIONAL SEASHORE FROM 2005-2014.

Year	# of pairs	Total Nests	#		Number Nests Lost to						Percentage Depredated Nests Lost to					
			Successful Nests	Unsuccessful	Overwash/Sanding Over	Abandonment ¹	Non-viable	Unknown	Other	Predation	Crows	Coyote	Gulls	Skunk	Fox	Unknown Predator
2005	77	118	48	70	33	11	1	0	4	21	24%	29%	10%	0%	0%	38%
2006	74	96	70	26	8	4	0	3	0	11	82%	0%	0%	0%	0%	18%
2007	82	113	66	47	24	12	0	2	0	9	44%	22%	0%	0%	0%	33%
2008	86	109	70	39	8	8	1	1	0	21	43%	5%	5%	19%	0%	29%
2009	83	108	54	54	16	9	1	2	1	25	68%	4%	4%	0%	0%	24%
2010	85	115	68	47	3	2	1	3	0	38	74%	5%	0%	0%	0%	21%
2011	82	110	61	49	8	9	1	2	0	29	83%	10%	0%	0%	0%	7%
2012	99	212	27	185	55	9	0	13	5	103	34%	40%	0%	0%	5%	21%
2013	85	173	30	143	28	7	0	2	2	103	23%	30%	0%	0%	5%	40%
2014	68	121	38	83	16	5	0	4	0	58	33%	16%	0%	0%	10%	22%
TOTAL	821	1275	532	743	199	76	5	32	12	418	42%	23%	1%	1%	4%	27%

¹Includes nests abandoned due to adult mortality

Field observations at the national seashore suggest that the majority of plover nests lost to American crows are due to a few individuals keying into the nesting areas. Their tracks blanket the sand and it is common for active nests prior to egg-laying to have crow tracks right up to them, suggesting that crows ate the egg(s) before the nests were found by shorebird staff. On May 10, on the southern tip of Coast Guard in Eastham 30–40 crows were observed foraging on the upper beach, some inside the symbolic fencing (figure E-1).

Crows also key into piping plover predator exclosures, perching on top or walking around the base of the exclosures, causing nest abandonment and possible adult mortality (figure E-2). They have also been observed depredating the newly hatched chicks as they leave the safety of the exclosure (figure E-3).

In addition to the national seashore, crows have been identified as significant piping plover predators at many other sites (e.g., L. Johnson per. comm. 2015; Brady and Ingelfinger 2008; USDA 2008; Lauro and Tanacredi 2002; NPS 2001c; Kruse et al. 2001; Maxson and Haws 2000). Even from a distance of 460 feet (140 meters) away, incubating piping plovers can be disturbed by American crows (Maxson 2000). Crows also contribute to loss of chicks and nests of American oystercatchers and least terns at the national seashore (NPS 2012; NPS 2013).



FIGURE E-1. CROWS FORAGING IN SHOREBIRD NESTING AREA INSIDE SYMBOLIC FENCING AT COAST GUARD BEACH IN EASTHAM ON MAY 10, 2014.

The Monomoy National Wildlife Refuge (2013) documented one piping plover nest lost to American crows in 2012. In 2013, a pair of American crows nested in shrubs and hatched chicks outside the main tern nesting site of Monomoy National Wildlife Refuge and three additional adult crows were observed flying, perching, and walking on islands. Through July, 22 piping plover nests (12 confirmed and 10 possible) were lost to these individual crows. Also in 2013, four adults and four chicks of American crow were removed from South Monomoy Island under a depredation order; the shrubs used for nesting were planned for removal in 2014.

American crows are widely distributed, exceedingly abundant across North America (Johnson 1994; Verbeek and Caffrey 2002) and have increased in the 20th century (BirdLife International 2009, Sauer et al. 2008). Crow roosts may number as many as a half-million birds in the United States (Verbeek and Caffrey 2002). The breeding biology of crows was studied on Cape Cod (1983–1987) and it was determined that family groups consisted of 2–10 crows that defended their territory year-round (Chamberlain-Auger et al. 1990). Within home ranges of breeding crows, egg predation was found to be higher on bird nests, than on nests placed outside of the home ranges at random locations (Sullivan and Dinsmore 1990). As discussed in USDA (2011a), crows are present year-round in Massachusetts (Robbins and Blom 1996) with an estimated statewide population of 110,000 crows based on the North American Bird Breeding Survey (BBS) data (Rich et al. 2004). Crow populations in Massachusetts are believed to be increasing as data (1996–2007) from the BBS indicate an annual rate increase of 1.2% (Sauer et al. 2008) and data collected during the NAS Christmas Bird Count has also shown a general increasing trend since 1966 (NAS 2010).



FIGURE E-2. AN AMERICAN CROW PERCHED ON A PIPING PLOVER NEST ENCLOSURE



FIGURE E-3. SAME AMERICAN CROW AS IN FIGURE E-1, NOW WITH A PIPING PLOVER CHICK IN ITS BILL (THAT IT TOOK AS THE NEWLY HATCHED CHICK LEFT THE SAFETY OF THE NEST ENCLOSURE)

Although crows are considered a migratory bird and protected by the MBTA, the MBTA does allow for the lethal take of crows (and some other migratory bird species) listed in 50 CFR 10.13 under depredation permits or depredation orders. Crows are also allowed to be lethally taken during migratory bird hunting seasons as established under guidelines developed by the US Fish and Wildlife Service and implemented by the Massachusetts Division of Fish and Wildlife. The US Department of Agriculture has the authority to conduct migratory bird damage management from permits issued by the US Fish and Wildlife Service under 50 CFR 21.41. For crows, “take” can also occur under the depredation order for blackbirds, cowbirds, grackles, crows, and magpies (50 CFR 21.43) established by the US Fish and Wildlife Service. However, the number of crows lethally removed to alleviate damage or threats of damage annually in Massachusetts is currently unknown. An unlimited number of crows can be taken during the hunting season in Massachusetts.

In fiscal year (FY) 2006–2010, USDA APHIS Wildlife Service controlled 64,394 crows in Massachusetts to manage damage or reduce threats; however, only 705 crows were taken lethally and the remainder were addressed with nonlethal techniques (e.g., deterrents/repellents). In FY 2009, 235 crows were lethally taken and in FY 2010, 302 crows were taken while 34,384 crows and 19,762 crows were controlled using nonlethal methods, respectively (USDA 2011a). In FY 2011, 21 crows were lethally removed for threatened and endangered species management. In total, for FY 2011, 374 crows were lethally taken during all USDA APHIS Wildlife Service projects in the state (T. Cozine, pers. comm. 2012). In FY 2012 and FY 2013, 38 and 100 crows (respectively) were lethally removed in Massachusetts for threatened and endangered species management (T. Cozine, pers. comm. 2014). The USDA APHIS Wildlife Service has analyzed the annual lethal take of up to 200 American crows and up to 50 fish crows to alleviate nest predation and annual lethal take of up to 500 American crows to alleviate threats to aviation and human health and safety at and around airports throughout the Commonwealth of Massachusetts (T. Cozine, pers. comm. 2014).

As discussed by the US Department of Agriculture (2011a), based on the estimated Massachusetts population size of 110,000 crows, the lethal take of 200 American crows to alleviate nest predation represents only 0.2%. The take of crows under the depredation order by other entities is believed to be a small contributor to the cumulative take of crows annually (USDA 2011a). The number of American crows observed during Massachusetts BBS and CBC surveys are showing increasing trends (NAS 2010; Sauer et al. 2008), and have likely remained at least stable despite the take of crows by the USDA APHIS Wildlife Service and other entities under the depredation order or permits (USDA 2011a).

RED FOX

Red fox have been identified as a predator of piping plovers and terns. The red fox population in Massachusetts is likely a nonnative species of European origin. These nonnative red fox are generalist predators that are capable of obtaining high densities in the human-altered landscape. Red fox have been shown to be significant nest predators for a wide variety of ground-nesting bird species including piping plovers, least terns, and American oystercatchers (Johnson and Sargeant 1977; Minsky 1980; Howe 1982; Lauro and Burger 1989; Sovada et al. 1995; Tapper et al. 1996; Neuman et al. 2004). Modeling by Seymour et al. (2004) using red fox movement data from northern England indicated that risk of fox predation on ground nesting bird species in long, linear habitats increased with narrowing habitat width, and was sensitive to changes in habitat width of even a few meters.

Red fox are considered stable throughout their range in the United States (Macdonald and Reynolds 2008) and occur statewide in Massachusetts except for Martha’s Vineyard and Nantucket (USDS

2011a). There are no current population estimates for red fox in Massachusetts, but populations of red fox are considered stable in the state (L. Conlee, pers. comm. 2014). Red fox are classified as a furbearer species for which established regulated hunting and trapping seasons and management program exists (MDFG 2014).

An unlimited number of red fox can be taken in Massachusetts during the annual hunting and trapping seasons which suggests the species is not at risk of overharvesting. The number of red fox reported by the Massachusetts Division of Fish and Wildlife as harvested and as take by the USDA APHIS Wildlife Service from 2006 through 2013 is shown in table E-2. It's elusive nature makes it difficult to determine population estimates. Any estimates extrapolated for populations in other areas should be used with caution (Voigt and Macdonald 1984), as other factors (e.g., competition from other canids [coyotes]) may influence distribution (Voigt and Earle 1983). In the 1980s, the statewide maximum supportable (preharvest) estimate for red fox in Maine was 4.05 fox/mi² of fox habitat for a statewide (preharvest) red fox population estimated at 74,162 fox (Caron 1986). The US Department of Agriculture (2011a) estimated that based on an assumption that red fox occupy 50% of the land area, and the density of red fox is 2.6 fox/mile² (equivalent to 1 fox/km²) the statewide population could be estimated at 10,200 red fox.

TABLE E-2. KNOWN TAKE OF RED FOX IN MASSACHUSETTS, 2006–2014

Year	Harvest Take ^{1,2}	WS Take ³	Total
2006	46	10	56
2007	48	6	54
2008	31	14	45
2009	53	14	67
2010	55	20	75
2011	42	13	55
2012	48	14	62
2013	N/A	13	N/A
2014	N/A	3	N/A
Total	323	107	414

¹Harvest take includes red fox reported as determined by pelt tagging and these numbers include animals taken through trapping, hunting, and salvaged (during the season)

²Reported by season; for example, the 2006 entry covers the hunting and trapping season that began in 2006 and ended in 2007 since the season often carry over from one calendar year to another with seasons general beginning in the fall and ending in the later winter

³WS take is reported by federal fiscal year

N/A = information that is not currently available

Source: USDA 2011a; data provided by L. Conlee pers. comm. 2014 and T. Cozine, USDA APHIS WS, pers. comm. 2014

Red fox are not currently significant predators of shorebirds within the national seashore however shorebird nests lost to red fox has increased since 2012. From 2006–2013, the Massachusetts annual harvest of red fox ranged between 31 to 55 (includes salvage = road kill) or 323 total for the eight year period; USDA-APHIS harvested an additional 107 red fox in Massachusetts from 2006–2014.

RACCOON

Raccoon have been identified as a predator of piping plovers and terns. Raccoons can be found throughout Massachusetts and adapted to rural, suburban, and urban areas but often in greater densities in urban than rural environments (USDA 2011a). The statewide population of raccoons is currently unknown, but the population is considered stable (L. Conlee, pers. comm. 2014). An unlimited number of raccoons can be taken in Massachusetts during the annual hunting and trapping seasons (except for a daily limit of three raccoons), which suggests the species is not at risk of overharvesting. The number of raccoon reported by the Massachusetts Division of Fish and Wildlife as harvested and as take by the USDA APHIS Wildlife Service from 2006 through 2013 is shown in table E-3. In the 1980s, Maine estimated a statewide raccoon population of 120,700 raccoons which was 74% of the maximum supportable population of 162,400 raccoons based on habitat quality and quantity (Connolly 1986). In more rural agricultural land, estimates of 1 raccoon/7.8 hectares (19.3 acres) have been found (Slate 1980) compared to 100 raccoons/mile² (equivalent to 1 raccoon/6.4 acres) where food sources are plentiful especially in coastal and wetland habitats (Kern 2002). Estimates of 9 to 45 raccoons/mile² in other states are common with fall population estimates of 98 to 101 raccoons/mile² in some counties (Illinois Department of Natural Resources 2006). As discussed in USDA (2011a), Riley et al. (1998) summarized rural raccoon densities based on published literature which ranged from approximately two raccoons to 650 raccoons/mile² in rural habitats with an average of 10 to 80 raccoons/mile². The US Department of Agriculture (2011a) estimated the statewide population of raccoons (as provided by Riley et al. [1998]), assuming that raccoons inhabit 50% of the land, to obtain a statewide population estimate from 7,900 raccoons to over 2.5 million raccoons.

TABLE E-3. KNOWN TAKE OF RACCOON IN MASSACHUSETTS, 2006–2014

Year	Harvest Take ^{1,2}	WS Take ³	Total
2006	234	7	241
2007	344	0	344
2008	239	5	244
2009	186	0	186
2010	237	1	238
2011	287	2	289
2012	77	3	80
2013	N/A	7	N/A
2014	N/A	3	N/A
Total	1,604	28	1,622

¹Harvest take includes raccoon reported as estimated through voluntary trapper surveys (there is no estimate for those harvest by hunting)

²Reported by season; for example, the 2006 entry covers the hunting and trapping season that began in 2006 and ended in 2007 since the season often carry over from one calendar year to another with seasons general beginning in the fall and ending in the later winter

³WS take is reported by federal fiscal year

Na = information that is not currently available

Source: USDA 2011a and data provided by L. Conlee pers. comm. 2014 and T. Cozine, USDA APHIS WS, pers. comm. 2014

Within Monomoy National Wildlife Refuge, raccoons were observed via tracks in 2010–2012. Since 2000, at MNWR, one raccoon has been lethally removed (MNWR 2013). From 2006–2013, the Massachusetts annual harvest of raccoons ranged between 77 to 344 (totals include salvage = road kill) or 1,604 total for the eight-year period; USDA-APHIS harvested an additional 28 raccoons in Massachusetts from 2006–2013 (MDFG 2014 and MNWR 2013).

STRIPED SKUNK

Striped skunks have been identified as a predator of piping plovers and terns. Striped skunks can be found in a variety of habitats across Massachusetts except for the Elizabeth Islands and Nantucket (USDA 2011a). Population estimates for striped skunks in Massachusetts are currently not available, but the population is thought to be stable (L. Conlee, pers. comm. 2014). An unlimited number of striped skunks can be taken in Massachusetts during the annual hunting and trapping seasons, which suggests the species is not at risk of overharvesting. The number of striped skunks reported by the Massachusetts Division of Fish and Wildlife as harvested and as take by the USDA APHIS Wildlife Service from 2006 through 2013 is shown in table E-4. Take reported by either organization is low (<25/year). Density estimates for striped skunk populations have ranged from 0.7 to 18.5 skunks/km², but most were 1.8 to 4.8 skunks /km² (Allen and Shapton 1942; Bailey 1971; Bennitt and Nagel 1937; Burt 1946; Jones 1939; Stout and Sonenshine 1974; Verts 1967 as cited in Reid and Helgen 2008). A population estimate by the US Department of Agriculture (2011a) determined if skunks occupy 50% of the land area of Massachusetts at 1 skunk/77 acres, the statewide population could be estimated at nearly 32,500 skunks based on the land area estimated at 7,838 square miles.

TABLE E-4. KNOWN TAKE OF STRIPED SKUNK IN MASSACHUSETTS, 2006–2014

Year	Harvest Take ^{1,2}	WS Take ³	Total
2006	8	0	8
2007	25	7	32
2008	23	1	24
2009	16	4	20
2010	12	10	22
2011	15	3	18
2012	0	7	Na
2013	N/A	10	N/A
2014	N/A	9	N/A
Total	99	51	141

¹Harvest take includes striped skunks reported as estimated through voluntary trapper surveys (there is no estimate for those harvested by hunting)

²Reported by season; for example, the 2006 entry covers the hunting and trapping season that began in 2006 and ended in 2007 since the season often carry over from one calendar year to another with seasons general beginning in the fall and ending in the later winter

³WS take is reported by federal fiscal year

N/A = information that is not currently available

Source: USDA 2011a and data provided by L. Conlee pers. comm. 2014 and T. Cozine, USDA APHIS WS, pers. comm. 2014

Within Monomoy National Wildlife Refuge striped skunks were observed from 2000–2011. Two striped skunks were lethally removed since 2000 at MNWR (MNWR 2013). From 2006–2013, the Massachusetts annual harvest of striped skunks ranged between 0–25 (totals include salvage = road kill) or 99 total for the eight-year period; USDA-APHIS harvested an additional 51 striped skunks in Massachusetts from 2006–2014 (MDFG 2014 and MNWR 2013).

VIRGINIA OPOSSUM

Virginia opossum have been identified as a predator of piping plovers and terns. Opossum are common throughout Massachusetts, except in Dukes and Nantucket Counties (USDA 2011a). Population estimates for opossum in Massachusetts are not available, but the population is thought to be stable (Conlee, pers. comm. 2014). An unlimited number of opossums can be taken in Massachusetts during the annual hunting and trapping seasons, which suggests the species is not at risk of overharvesting. The number of opossum reported by the Massachusetts Division of Fish and Wildlife as harvested and as take by the USDA APHIS Wildlife Service from 2006 through 2013 is shown in table E-5. Opossums are widespread and increasing (Cuarón et al. 2008). The US Department of Agriculture (2011a) population estimate was derived based on information for opossum using the range found by Seidensticker et al. (1987) that estimated 1.3 opossum/mile² to 20.2 opossum/mile². Assuming that only 50% of the land area of Massachusetts is inhabited by opossum, the statewide population would range from 5,100 opossum to 79,200 opossum. Most likely opossum inhabit more than 50% of the land as they are adapted to urban environments as well (USDA 2011a).

TABLE E-5. KNOWN TAKE OF OPOSSUM IN MASSACHUSETTS, 2006–2014

Year	Harvest Take ^{1,2}	WS Take ³	Total
2006	25	0	25
2007	79	0	79
2008	38	0	38
2009	30	4	34
2010	74	0	74
2011	43	1	44
2012	N/A	1	N/A
2013	N/A	1	N/A
2014	N/A	0	N/A
Total	289	7	294

¹Harvest take includes opossum reported as estimated through voluntary trapper surveys (there is no estimate for those harvest by hunting)

²Reported by season; for example, the 2006 entry covers the hunting and trapping season that began in 2006 and ended in 2007 since the season often carry over from one calendar year to another with seasons general beginning in the fall and ending in the later winter

³WS take is reported by federal fiscal year

N/A = information that is not currently available

Source: USDA 2011a and data provided by L. Conlee pers. comm. 2014 and T. Cozine, USDA APHIS WS, pers. comm. 2014

Within MNWR Virginia opossum were observed from 2007–2012 with documented predation of shorebirds by the opossum occurring in 2008 and 2009. Since 2000, 10 Virginia opossums have been lethally removed (MNWR 2013). From 2006–2013, the Massachusetts annual harvest of Virginia opossums ranged between 25 to 79 (totals include salvage = road kill) or 289 total for the eight-year period; USDA-APHIS harvested an additional seven Virginia opossums in Massachusetts from 2006–2014 (MDFG 2014 and MNWR 2013).

GULLS

Gulls (*Larus* spp.) are opportunistic feeders, exploiting virtually any food source available. At sea, they forage on small fish and along the coast they forage on mollusks, crustaceans, invertebrates, insects, shorebird eggs and chicks, other smaller birds, and human food scraps. Open landfills and outflow from sewage treatment plants were once primary food sources for gulls, but most of these facilities are now capped and closed. The disposed byproducts of the commercial fishing industry (both from boats and processing plants) and freshly plowed farm fields exposing invertebrates provide additional forage for gulls. Gulls can feed on special status shorebird species with the potential to cause negative population impacts to those species (USDA 2010a).

Gulls have been identified as a predator of piping plovers and terns. The USDA APHIS Wildlife Service program in Massachusetts receives requests for assistance to resolve or prevent damage occurring to agricultural resources, natural resources, and property, including threats to human safety, for gulls, including herring gulls (*Larus argentatus*), ring-billed gulls (*Larus delawarensis*), great black-backed gulls (*Larus marinus*), and laughing gulls (*Larus atricilla*).

Although gulls are considered a migratory bird and protected by the MBTA, the MBTA does allow for the lethal take of gulls (and some other migratory bird species) listed in 50 CFR 10.13 under depredation permits or depredation orders. The US Department of Agriculture has the authority to conduct migratory bird damage management from permits issued by the USFWS under 50 CFR 21.41. A separate environmental assessment was developed by the USDA APHIS Wildlife Service for gull management activities and should be referred to for extensive information on population modeling and estimates for several gull species (USDA 2010a).

Herring gull and great black-backed gull populations in Massachusetts are declining (MNWR 2013). The herring gull, which is generally considered abundant in the state, now number less than 10,000 breeding pairs and is apparently one of the fastest declining species of breeding birds in the state (Melvin 2010). The decline of nesting herring gull and great black-backed gull in the MNWR is attributed, in part to Eastern coyote predation. Many MNWR gull colonies occur on islands historically occupied by several tern species. The gulls have forced terns to use less desirable nesting sites on the mainland, seriously affecting breeding success for the tern species. Herring gulls are daytime predators of common terns; great black-backed gulls are both a day and nighttime predator of common terns, and both species use habitat preferred by common terns (MNWR 2013).

In 1996, USDA APHIS Wildlife Service conducted a herring gull and great black-backed gull colony reduction project at the request of Monomoy National Wildlife Refuge and removal of the gulls resulted in an expansion of common and roseate tern nesting on South Monomoy Island (USDA 2010a). Since 1998, MNWR selectively removed by shooting, 21 herring gulls and 110 great black-backed gulls at a rate of 0–7 and 0–37 individuals per year, respectively. In 1980 (and again in May 1996), avicide was used to lethally remove herring and great black-backed gulls from a common tern nesting area. Current MNWR flexible gull management includes destruction of nests in/near tern/plover nesting colonies and shooting predatory individual gulls of either species.

The laughing gull population in Massachusetts is increasing (MNWR 2013) and they have rapidly increased in nesting population at MNWR in the early 2000s resulting in direct competition with common and roseate terns. Laughing gulls nest in dense vegetation and prey on common tern chicks and eggs most years at Monomoy National Wildlife Refuge; they also harass and steal fish from adult terns reducing the amount of food fed to chicks (successful from 32% to 57% of observed fish-stealing attempts). In 2004, a prescribed burn was conducted in Monomoy National Wildlife Refuge to reduce dense shrub vegetation cover and increase available common tern nesting habitat; between 2005–2009, 300–1,600 laughing gull nests and eggs (not chicks) were destroyed annually to maintain a lower population (from 1,000–1,100 nesting pairs) in MNWR (2013). The Monomoy National Wildlife Refuge continues to implement predator management when needed to prevent the expansion of herring gull, great black-backed gull, and laughing gull nest colonies on South Monomoy Island.

The ring-billed gull population is generally increasing (NatureServe 2014) and it is considered a nonbreeder in Massachusetts. They commonly occur within the national seashore and likely are predators of shorebird eggs and chicks as are the other species of gulls.

OTHER PREDATORS

Other predators may emerge in the national seashore dynamic ecosystem that cannot be predicted, but would be treated through integrated predator management adaptively. Bird species that have been noted as predators on adjacent Monomoy National Wildlife Refuge are included in this group as summarized below.

Northern Harrier, Common Grackle, Falcons, and Owls

The northern harrier (*Circus cyaneus*) is a Massachusetts state threatened species. In 2004–2005, a two year field study on the breeding ecology of Northern harriers was conducted at the national seashore. The key findings of that study (Bowen 2006) documented 10 nesting pairs of harriers in 2004, likely the largest breeding population found on the mainland of Massachusetts and of conservation significance. In 2005, five breeding pairs were documented. Some of the primary nesting areas for the harrier at the national seashore includes the upper salt marsh/backdune habitats at Hatches Harbor and the marshes of Bound Brook Island. At the national seashore, one unexclosed piping plover nest was predated by Northern harrier in 2005 and they have been observed on several occasions perched on piping plover predator exclosures. Northern harriers also nest within Monomoy National Wildlife Refuge and are suspected of killing adult piping plovers in and near predator exclosures (in 2001–03 - most of the 15 known plover mortalities at exclosed nests; 2002 – 1 adult plover; 2004 – 1 adult female plover; 2004 – 2 adult plovers). From 1998–2012 northern harriers predated 67 common tern chicks and 45 common tern adults within Monomoy National Wildlife Refuge (2013). However, the MNWR staff does not manage northern harriers, rather presence and depredation data are recorded when observed.

Common grackles are ubiquitous and the population is considered stable in Massachusetts. They are a common species in the national seashore and at Monomoy National Wildlife Refuge, nesting primarily in freshwater wetlands. Common grackles are omnivorous ground-foragers of seeds, insects, aquatic animals, small mammals, shorebird eggs and chicks, and carrion including fish, wildlife, and marine mammal carcasses. Individuals of the species can learn to target piping plover nests that are surrounded by predator exclosures and they were documented taking piping plover

eggs and chicks in Monomoy National Wildlife Refuge in 2012 (three lost piping plover nests) and 2013 (six piping plover nests were predated by common grackles, up to July 26) (MNWR 2013).

In general, for falcon species, both the merlin and American kestrel populations are strongly declining in Massachusetts, while the peregrine falcon population is increasing; all three species occur within the national seashore and in Monomoy National Wildlife Refuge. The refuge (2013) does not manage falcon species; however, presence and shorebird depredation data are recorded when observed. In 2004, MNWR staff observed a peregrine falcon killing one adult piping plover.

The great horned owl population is likely increasing in Massachusetts as a widespread but uncommon raptor. They have been observed in both the national seashore and Monomoy National Wildlife Refuge and have been documented nesting intermittently since 2000 (MNWR 2013). Since 1999, great horned owls have been documented in the MNWR common tern colony during 17 nights causing nocturnal nest/colony abandonment and killing 15–20 adult terns and several chicks. In 2000, they caused nocturnal nest/colony abandonment every night from May 11–June 14 and in 2001, caused nocturnal nest/colony abandonment in May/June, resulting in many dead tern chicks (MNWR 2013). Use of triangular signs prevented great horned owl perching on Monomoy National Wildlife Refuge; however, they also hunt from the ground. MNWR personnel are prepared to lethally manage great horned owls preying in the common tern colony at night but to date, no individuals have been lethally removed.

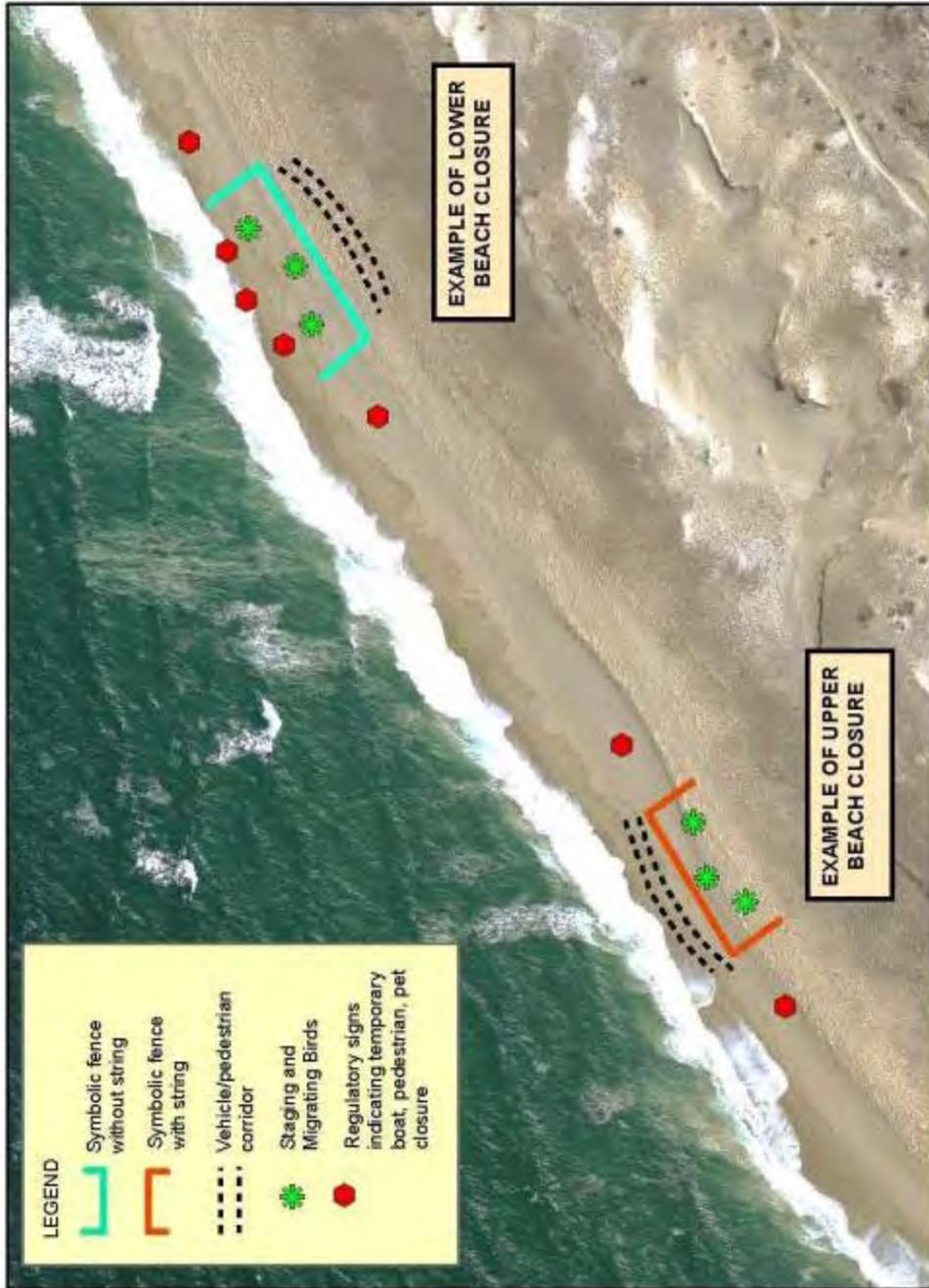
APPENDIX F: MAPS OF HATCHES HARBOR SHOWING PET RESTRICTION AND SIGNAGE AND BUOY LOCATIONS FOR STAGING/MIGRATING SHOREBIRDS FOR ALTERNATIVES A, B, AND C, AND EXAMPLES OF UPPER AND LOWER BEACH CLOSURES



Hatches Harbor for Alternatives A and C



Hatches Harbor for Alternative B



Examples of Upper and Lower Beach Closures

APPENDIX G: SUMMARY OF ALTERNATIVES

SUMMARY OF ALTERNATIVES

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
Symbolic Fencing and Buffers	Piping Plovers			
	Most suitable habitat on beaches would be symbolically fenced by April 1, or soon thereafter. Symbolic fencing and signs would be installed around concentrations of staging/migratory shorebirds and all areas where plovers are observed exhibiting courtship and territorial behavior and/or where active scrapes or nests are present with the exceptions noted above in the "Flexible Management" section.			
Symbolic fencing is used to identify and protect shorebird nesting and/or staging habitat and provide a buffer between the birds and human disturbance. Five- or 6-foot (1.5–2.0-meter) wooden posts would be used and placed approximately 40–50-feet (12–15-meters) apart, connected by a line of cotton twine to delineate habitat. Plastic and wooden "Area Closed–Bird Use Area" informational signs would be affixed to every second or third post.				
Symbolic Fencing of Life-Guarded Beaches	Symbolic fencing would not initially be installed on four life-guarded sections of beaches: Coast Guard Beach in Eastham, Marconi Beach, Nauset Light, and Herring Cove, equaling a total length of no more than 0.75 mile. These beaches would be closely monitored. Symbolic fence may be installed if/when a concentration of piping plover tracks and/or territorial or courtship behavior is observed; or these sections of beach would be considered for flexible management. The amount of fencing and timing varies from year to year, but approximately 27 miles (44 km) of beach that is suitable shorebird habitat in the national seashore is being symbolically fenced each year.	Symbolic fencing would not be installed on portions or all of the national seashore's six life-guarded beaches: Coast Guard Beach in Eastham, Nauset Light, Marconi Beach, Head of the Meadow, Race Point, and Herring Cove. The beaches and nominal approximate lengths that would not be symbolically fenced are as follows: Coast Guard (Eastham): 1,634 feet (498 meters) of life-guarded beach. Nauset Light: 1,319 feet (402 meters) of life-guarded beach. Marconi Beach: 1,319 feet (402 meters) of life-guarded beach. Head of the Meadow: 285 feet (87 meters) of the life-guarded lower beach (roughly the lower 2/3). If in the future the area of use by nesting shorebirds shifts laterally, north or south, away from the life-guarded beach area, Head of the Meadow life-guarded beach would be considered for additional lengths of not symbolically fenced life-guarded beach.	Same as alternative A.	Same as alternative B.

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
		<p>Herring Cove: 1,204 feet (367 meters) of life-guarded beach. Race Point: 1,204 feet (367 meters) of the life-guarded lower beach (roughly the lower third of the beach) would not be symbolically fenced to provide shorebird protection. If in the future the Race Point life-guarded beach seasonally narrows, similar to the configuration of Marconi or Nauset Light Beaches, this entire life-guarded beach would also be considered to remain unfenced to provide continued public access. The total length of all life-guarded beaches that would not initially be symbolically fenced would be 6,965 feet (1.3 miles or 2.1 kilometers).</p>		
<p>Symbolic Fencing in ORV Corridors</p>	<p>ORV Corridor</p>			
	<p>An oversand route is closed at any time that tides, nesting birds, or surface configuration prevent vehicle travel within the designated corridor (Neg Regs). Therefore, placement of symbolic fencing to protect nesting shorebirds may temporarily close sections of the ORV corridor during the nesting season.</p>			
	<p>Management of ORV access along the corridor (including Pole Line Road) will continue to be based on the 1998 Neg Regs, and the USCG/ALF Race Point Lighthouse Essential Vehicle Management Plan.</p>			
<p>Vehicles would be allowed access in the designated ORV corridor during the egg laying and incubating phase of the nesting</p>	<p>Same as alternative A.</p>	<p>Same as alternative A.</p>	<p>All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to ORV access</p>	

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	season provided that the beach is wide enough to adequately provide a protective buffer between the incubating shorebird and the passing vehicles.			from March 15–October 15.
Symbolic Fencing in ORV Corridors	Piping Plovers			
	Areas open to ORVs would continue to be managed in accordance with the procedures in the “Motor Vehicle Management” section of the 1994 USFWS Piping Plover Guidelines that outlines dates and criteria for the protection of nesting plovers in areas open to ORVs including the installation of symbolic fencing, vehicle restrictions, and monitoring efforts needed for different vehicle access scenarios. Areas of the ORV corridor not opened to ORVs would be managed in accordance with the procedures in the “Management of Non-Motorized Recreational Uses” section of the 1994 USFWS Piping Plover Guidelines until they re-open to vehicles.	Same as alternative A.	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to ORV access from March 15–October 15.
	Some portions of suitable habitat on beaches outside the ORV corridor that receive relatively little pedestrian visitation might not be symbolically fenced. On beaches that are not symbolically fenced, symbolic fencing and signs would be installed around all areas where shorebirds are observed exhibiting territorial and courtship behavior and where scrapes and nests are discovered.			
To provide vehicle access past nests on narrow beaches, “drive through only” corridors may be established if the incubating birds remain on the nest when the vehicle passes by and the vehicle corridor is in compliance with the 1998 Neg Regs. Vehicles would be prohibited from stopping in these designated areas and must	To provide vehicle access past these nests, “drive through only” corridors may be established if: (1) the nest or territorial /courting behavior (including nests prior to egg laying) is at least 82 feet (25 meters) from the drive-through corridor, (2) the birds are tolerant of this reduced buffer, (3) the beach topography allows adequate	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to ORV access from March 15–October 15.	

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	drive no faster than 5 mph through these areas. If the beach with nesting shorebirds is too narrow to drive on, it would be closed to vehicular traffic.	visibility for vehicles to see birds that are in or approaching/ crossing the driving lane, and (4) vehicles drive 5 mph or less through this area. Vehicles would be prohibited from stopping in these designated areas. If the section of beach with the nesting shorebird is too narrow to drive on, it would be closed to vehicular traffic.		
Symbolic Fencing in ORV Corridors	ORV Corridor			
	An oversand route is closed at any time that tides, nesting birds, or surface configuration prevent vehicle travel within the designated corridor (Neg Regs). Therefore, placement of symbolic fencing to protect nesting shorebirds may temporarily close sections of the ORV corridor during the nesting season.			
	Management of ORV access along the corridor (including Pole Line Road) will continue to be based on the 1998 Neg Regs, and the USCG/ALF Race Point Lighthouse Essential Vehicle Management Plan.			
	Vehicles would be allowed access in the designated ORV corridor during the egg laying and incubating phase of the nesting season provided that the beach is wide enough to adequately provide a protective buffer between the incubating shorebird and the passing vehicles.	Same as alternative A.	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to ORV access from March 15–October 15.
	Piping Plovers			
Areas open to ORVs would continue to be managed in accordance with the procedures in the "Motor Vehicle Management" section of the 1994 USFWS Piping Plover Guidelines, which outlines dates and criteria for the protection of nesting plovers in areas open to ORVs including the installation of symbolic fencing, vehicle restrictions, and monitoring efforts needed for different vehicle access scenarios. Areas of the	Same as alternative A.	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to ORV access from March 15–October 15.	

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	<p>ORV Corridor not opened to ORVs would be managed in accordance with the procedures in the "Management of Non-Motorized Recreational Uses" section of the 1994 USFWS Piping Plover Guidelines until they re-open to vehicles.</p>			
<p>Symbolic Fencing in ORV Corridors</p>	<p>Some portions of suitable habitat on beaches outside the ORV corridor that receive relatively little pedestrian visitation might not be symbolically fenced. On beaches that are not symbolically fenced, symbolic fencing and signs would be installed around all areas where shorebirds are observed exhibiting territorial and courtship behavior and where scrapes and nests are discovered.</p>			
	<p>To provide vehicle access past nests on narrow beaches, "drive through only" corridors may be established if the incubating birds remain on the nest when the vehicle passes by and the vehicle corridor is in compliance with the 1998 Neg Regs. Vehicles would be prohibited from stopping in these designated areas and must drive no faster than 5 mph through these areas. If the beach with nesting shorebirds is too narrow to drive on, it would be closed to vehicular traffic.</p>	<p>To provide vehicle access past these nests, "drive through only" corridors may be established if: (1) the nest or territorial/courting behavior (including nests prior to egg laying) is at least 82 feet (25 meters) from the drive-through corridor, (2) the birds are tolerant of this reduced buffer, (3) the beach topography allows adequate visibility for vehicles to see birds that are in or approaching/crossing the driving lane, and (4) vehicles drive 5 mph or less through this area. Vehicles would be prohibited from stopping in these designated areas. If the section of beach with the nesting shorebird is too narrow to drive on, it would be closed to vehicular traffic.</p>	<p>Same as alternative A.</p>	<p>All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to ORV access from March 15–October 15.</p>
	<p>If possible, symbolic fencing would be adjusted to allow for an SCV area where there is no shorebird activity. In the spring (prior to Memorial Day weekend), the SCV area would not be larger than 0.1 mile (161 meters) long. Starting with the Friday before Memorial Day weekend, the two SCV areas combined would be no larger than 0.3 mile (483 meters)</p>	<p>Same as alternative A.</p>	<p>Same as alternative A.</p>	<p>All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to ORV access from March 15–October 15.</p>

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	<p>long. All possible efforts would be made to ensure that SCV areas are distributed between Race Point North and Race Point South to reduce effects on shorebirds on any one section of beach. If only one SCV area exists, the total length would not exceed 0.2 mile (322 meters). The SCV area would be no larger than 75 feet (23 meters) deep at any time during the bird nesting/staging season.</p>			
<p>Symbolic Fencing in ORV Corridors</p>	<p>As eggs in nests hatch, sections of beach within the ORV corridor would be closed to protect flightless chicks. These vehicle closures extend 0.2 mile (322 meters) on each side of the broods. Actual closure limits for each brood are adjusted and may be expanded based on beach morphology, brood behavior, or other conditions as appropriate to ensure the chicks are protected.</p>	<p>Same as alternative A.</p>	<p>Same as alternative A.</p>	<p>All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to ORV access from March 15–October 15.</p>
	<p>Least Terns</p>			
	<p>Management of ORV corridor with nesting least terns would be based on the 1998 Neg Regs, and the 1993 State Guidelines. The 1993 State Guidelines recommend providing a 150-foot (46-meter) radius buffer around nests above the high tide line. Fencing around nests would be evaluated and adjusted depending on the behavior of individual birds.</p>	<p>Management of ORV access would continue to be based on the 1998 Neg Regs. Within the context of the 1998 Neg Regs, every least tern nest would be protected using symbolic fencing. National seashore will follow the 1993 MADFW Guidelines where possible, but protective buffers may vary depending on the management scenario.</p>	<p>Same as alternative A.</p>	<p>All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to ORV access from March 15–October 15.</p>
	<p>As eggs in nests hatch, sections of the ORV corridor would be closed to protect the flightless</p>	<p>Same as alternative A.</p>	<p>Same as alternative A.</p>	<p>All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat</p>

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	least tern chicks until they fledge. These vehicle closures extend at least 300 feet (91 meters) from each side of the brood; however, actual closure limits for each brood would be adjusted based on beach morphology, brood behavior, or other conditions, as appropriate.			would be closed to ORV access from March 15–October 15.
Symbolic Fencing in ORV Corridors	In addition, rearing or nursery areas used by unfledged or recently fledged tern chicks would be delineated with posts, warning signs, or symbolic fencing. All access by vehicles into posted tern nursery areas should be prohibited while unfledged or recently fledged tern chicks are present in these areas, until it is determined that use of nursery areas by young terns has ended (i.e., young terns are no longer being fed by adult terns). Nursery areas are not always at nest sites.	Same as alternative A.	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to ORV access from March 15–October 15.
American Oystercatcher				
Areas open to ORV access would be based on the Neg Regs.				
	American oystercatchers would be evaluated on-site and management decisions would be made on a case-by-case basis. Symbolic fencing and buffers would be placed around nests to reduce harm or minimize disturbance to incubating adults, eggs, or unfledged chicks.	Every American oystercatcher nest would be protected using symbolic fencing but protective buffers may vary depending on the management scenario. Symbolic fencing and buffers would be placed around nests to reduce harm or minimize disturbance to incubating adults, eggs, or unfledged chicks.	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to ORV access from March 15–October 15.
	As eggs in nests hatch, sections of beach within the ORV corridor would be closed to protect the flightless chicks. These vehicle closures generally extend 656 feet (200 meters) from each side	Same as alternative A.	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to ORV access from March 15–October 15.

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
<p>of the brood; however, actual closure limits for each brood would be adjusted based on beach morphology, brood behavior, or other conditions, as appropriate.</p>				
	Staging/Migratory Birds			
	<p>In addition, staging and migratory shorebirds sometimes congregate on sections of upper (dry) beach to rest, especially at high tide. To reduce disturbance, symbolic fencing/signs may be installed around these flocks or remain on beaches after shorebird nesting is complete. Areas along the corridor where this has occurred include, for example, Hatches Harbor, Race Point, and Exit 9 to High Head.</p> <p>On stretches of beach where more than 100 roseate terns or red knots or other staging/migrating shorebirds are observed, sections of the ORV corridor may be temporarily closed if suitable buffers to reduce disturbance cannot be established. All efforts would be made to provide ORV access around the birds, when possible.</p>	<p>Same as alternative A.</p>	<p>Same as alternative A.</p>	<p>All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to ORV access from March 15–October 15.</p>
<p>Symbolic Fencing Pole Line Road and Inner Dune Route</p>	Pole Line Road and Inner Dune Route (for access to dune shacks)			
	<p>The Pole Line Road and Inner Dune Route would not be considered for flexible management and would be managed in accordance with the Neg Regs. The route would not be open if plovers or terns are exhibiting territorial or nesting</p>	<p>The Pole Line Road and Inner Dune Route would be managed in accordance with the Neg Regs. Although, sections of the Pole Line Road and Inner Dune Routes would be considered for flexible management and would not be symbolically fenced in the spring</p>	<p>Same as alternative A.</p>	<p>The Pole Line Road and Inner Dune Route would be managed in accordance with the Neg Regs. Unless sections of outer beach immediately accessible by these access routes are open to ORV use (i.e., not closed for shorebird protection as described in this</p>

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	<p>behavior in or adjacent to the route. If nesting activity is close to the Pole Line Road, a “drive through only” may be established past the nesting activity if the birds are not disturbed (e.g., remain on the nest) when the vehicle passes. Vehicles would be prohibited from stopping in these designated areas and must drive no faster than 5 mph. The Pole Line Road would only be used by public vehicles when the superintendent opens the route due to high tides, beach erosion, shorebird closure or other circumstances that would, as a result, warrant public use of this access way.</p> <p>The Pole Line Road would only be used by public vehicles when the superintendent opens the route due to high tides, beach erosion, shorebird closure or other circumstances that would, as a result, warrant public use of this access way.</p> <p>If piping plover nests are established on or in proximity to the Inner Dune Route, an operational plan would be developed on a case-by-case basis.</p>	<p>and would remain open as travel routes. If piping plover nests (including scrapes) are established on or in proximity to the Pole Line Road and it is apparent, through observation, that the plover adults are likely to abandon a nesting attempt or would stop incubating eggs as vehicles passed, the road would be closed to vehicles and symbolic fencing would be erected. If piping plovers nest off the Pole Line Road, including in the cobblefield, the road would remain open as a 5 mph drive-through section with no pedestrian access until hatching.</p> <p>The Pole Line Road would only be used by public vehicles when the superintendent opens the route due to high tides, beach erosion, shorebird closure or other circumstances that would, as a result, warrant public use of this access way.</p> <p>If piping plover nests are established on or in proximity to the Inner Dune Route, an operational plan would be developed on a case-by-case basis.</p>		<p>alternative), the Pole Line Road and Inner Dune Route would be closed for general or commercial ORV use but available for access to dune shacks and the race point lighthouse. If piping plover nests are established on or in proximity to the Inner Dune Route, an operational plan would be developed on a case-by-case basis.</p> <p>Same as alternative B.</p>
Symbolic Fencing on Other Beaches	Piping Plovers and Least Terns			
	Some portions of suitable habitat on these beaches outside the ORV corridor and life-guarded beaches that receive relatively little pedestrian visitation would not initially be symbolically	Same as alternative A.	Same as alternative A.	During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	<p>fenced. On these beaches, symbolic fencing and signs would be installed around all areas when/where piping plovers are observed exhibiting territorial and courtship behavior and/or where scrapes (a type of bird nest that is a shallow depression in the sand) and nests are discovered.</p> <p>Once nests are discovered, a 164-foot (50-meter) radius buffer would be installed around nests above the high tide line. Fencing around nests would be evaluated and might be expanded or reduced depending on the tolerance of the birds to disturbance. In cases where the nest is less than 164 feet (50 meters) above the high tide line, fencing would be placed at the high tide line and response of individual or more piping plover(s) to pedestrians would be monitored.</p> <p>If the piping plover does show signs of disturbance, a primary fenceline would be placed along the high tide line. An additional secondary fenceline (with no string) would be installed and extend into the intertidal zone, providing the adequate buffer distance from the nest to prevent disturbance. This section of beach may need to be temporarily closed to provide adequate protection.</p>			<p>points where breeding, feeding, or sheltering activities are observed would be closed to visitor use , except at the six national seashore life-guarded beaches.</p>
	<p>Areas of suitable plover habitat that have been symbolically fenced would be carefully</p>	<p>Same as alternative A.</p>	<p>Same as alternative A.</p>	<p>During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and</p>

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	<p>monitored as part of the national seashore normal monitoring program. If, on June 30, no eggs or chicks are present, symbolic fencing specific to plover protection would be removed starting on July 1. The rest of the symbolic fencing is removed in mid-to-late October once the majority of the special status migratory species have migrated south.</p>			<p>other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches.</p>
<p>Symbolic Fencing on Other Beaches</p>	<p>Symbolic fencing and signs would be installed around all suitable least tern nesting habitat, including tern habitat that overlaps the ORV corridor where least terns are observed exhibiting courtship behavior and/or where active scrapes and/or nests are present. The 1993 MADFW Guidelines recommend providing a 50-yard (46-meter) radius buffer around least tern nests above the high tide line. Fencing around nests would be evaluated and may be adjusted, smaller or larger depending on the behavior of individual birds (i.e., tolerance to disturbance). In cases where the nest is less than 50 yards (46 meters) above the high tide line, fencing would be placed at the high tide line and a shorebird biological technician would monitor the response of the terns to pedestrians.</p>	<p>Same as alternative A.</p>	<p>Same as alternative A.</p>	<p>During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches.</p>
	<p>Symbolic fencing would be installed providing an adequate buffer around nests to prevent harm or minimize disturbance to</p>	<p>Same as alternative A.</p>	<p>Same as alternative A.</p>	<p>During the shorebird season (from March 15 to October 15), all historic shorebird-use-areas and other priority habitats, entire</p>

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	incubating adults, eggs, or unfledged chicks.			sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches.
	Some portions of suitable habitat on beaches outside the ORV corridor that receive relatively little pedestrian visitation may not initially be symbolically fenced. On these beaches, symbolic fencing and signs would be installed around all areas where least terns are observed exhibiting territorial and courtship behavior and where active scrapes or nests are discovered. All least tern nests would be protected, even individual nests isolated from a larger colony.	Same as alternative A.	Same as alternative A.	During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches.
Symbolic Fencing on Other Beaches	American Oystercatcher			
	American oystercatchers would be evaluated on-site and management decisions would be made on a case-by-case basis. In most cases, American oystercatchers nest within established and protected piping plover and least tern nesting areas.	Same as alternative A.	Same as alternative A.	During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches.
	Symbolic fencing and signs would be installed around all areas where American oystercatchers are observed exhibiting courtship behavior and/or where scrapes and/or nests are present. A buffer would be placed around nests to	Same as alternative A.	Same as alternative A.	During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	reduce harm or minimize disturbance to incubating adults, eggs, or unfledged chicks.			sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches.
	On narrow sections of beach, symbolic fencing would be placed at the high tide line. Shorebird staff would monitor response of the birds to pedestrians. If the American oystercatcher show signs of disturbance, a primary fenceline would be placed along the high tide line and an additional secondary fenceline (with no string) might be installed and extend into the intertidal zone. This second line of fence may wash away at high tide and need regular replacing.	Same as alternative A.	Same as alternative A.	During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches.
Symbolic Fencing on Other Beaches	Staging/Migrating Shorebirds			
	Staging/migrating bird closures would be established for roseate terns, red knots, and other shorebirds along sections of beach throughout the national seashore. During staging and migration, these birds tend to concentrate on upper (dry) sections of beach at high tide when sand flats are inundated by water. To reduce disturbance to birds resting along the upper beach, symbolic fencing with string and "Area Closed – Bird Use Area" signs may be installed around these flocks or remain up on beaches after shorebird nesting is complete to protect arriving staging/migrating shorebirds. Areas where this management strategy has occurred include Coast Guard in	Same as alternative A.	Same as alternative A.	During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches.

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	<p>Eastham, Jeremy Point, Hatches Harbor, and Duck Harbor.</p> <p>All suitable habitat on Hatches Harbor Spit would be symbolically fenced. Symbolic fencing may stay up to protect nesting, staging, and migratory shorebirds.</p>	<p>Same as alternative A.</p>	<p>Same as alternative A.</p>	<p>During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches.</p>

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
<p>Symbolic Fencing at Parking Lots</p>	<p>Parking lots in proximity to piping plover nesting areas (e.g., Head of the Meadow) would be monitored frequently for activity and may close if there is shorebird activity. If there is concern of unfledged chicks accessing a parking lot from the beachfront, silt fencing or other similar material would be installed around sections of the perimeter of the parking lot and across pedestrian walkways. A set of stairs would be positioned over the silt fencing, at the main southern pedestrian path to provide pedestrian access to the beach.</p> <p>Certain pedestrian pathways may be temporarily closed at times. If, after silt fencing, chicks are still observed in the parking lot, staff would be stationed in the lot each day until adults and chicks are no longer using the area and the lot may be temporarily closed.</p> <p>Parking lots would be kept clean of accumulated sand or standing water.</p>	<p>Parking lots would remain open regardless of shorebird activity.</p> <p>Parking lots in proximity to plover nesting areas (e.g., Head of the Meadow) would be monitored frequently for piping plover activity. If there is concern that piping plover chicks may access a parking area from the beach, silt fencing or other similar material would be installed around sections of the perimeter of the parking lot and along any pedestrian walkway before the chicks hatch or immediately after chicks are observed near or in the parking lot. If a flightless chick or brood is observed in a parking lot, the lot would be temporarily closed to vehicle activity until chicks were “herded” back to the beach by shorebird staff. If adult birds are observed in the lot, shorebird staff would approach the bird(s), causing them to fly away. If bird activity (adult or chicks) occurred in a parking lot, shorebird staff would closely monitor the lot during the nesting season.</p> <p>Parking lots would be kept clean of accumulated sand or standing water.</p>	<p>Same as alternative A.</p>	<p>Same as alternative B.</p>
<p>Flexible Management</p>	<p>Piping Plover</p> <p>Flexible management would consist of not installing symbolic fencing around piping plovers observed exhibiting courtship behavior and/or where there are active nests before eggs are laid (scrapes) within a section of a particular beach. If a nest is found within this area, the nest would be provided minimal protection. Symbolic fencing and signs would be erected to prevent the nest from being stepped on, but with less buffer distance than recommended in the 1994 USFWS Piping Plover Guidelines. If eggs in the nest hatch under these conditions, the lateral symbolic fencing would be maintained to provide a travel corridor for the chicks. Predator exclosures would not be installed around nests.</p>			

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
Flexible Management	<p>Up to two beaches in the national seashore can be flexibly managed, with a maximum of up to 820 feet (250 meters) of beach at one site (measured from pedestrian access point), and a seashore-wide total of up to 1,312 feet (400 meters) and regardless of the length of beach.</p> <p>A lateral buffer (parallel to the water) of 131 feet (40 meters) on each side of the nest would be installed, but the buffer would not extend far enough out toward the water to impede pedestrian access past the nesting area at high tide. If eggs within the nest hatch under these conditions, the lateral symbolic fencing would be maintained to provide a travel corridor for the chicks.</p>	<p>A lateral buffer (parallel to the water) of 33 feet (10 meters) on each side of the nest would be installed, but the buffer would not extend far enough out toward the water to impede pedestrian access past the nesting area at high tide. If eggs within the nest hatch under these conditions, the lateral symbolic fencing would be maintained to provide a travel corridor for the chicks.</p>	Same as alternative A.	Same as alternative B.
	No more than three pairs of plovers total in a season would be flexibly managed.	No more than five pairs of plovers total in a season would be flexibly managed.	Same as alternative A.	Same as alternative B.
	No flexible management of parking lots under this alternative.	<p>Parking lots at the national seashore would remain open regardless of shorebird activity. If a flightless chick or brood is observed in a parking lot, the lot would be temporarily closed to vehicle activity until the chick or brood is herded back to the beach by shorebird staff and silt fencing or like material is in place. If adult birds are observed in the parking lot shorebird staff would approach the bird(s) causing them to fly away. Since it is likely that birds may return to a parking lot shorebird staff would closely monitor the parking lot for any bird activity (adult or chicks) throughout the rest of the nesting</p>	Same as alternative A.	Same as alternative B.

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	No flexible management of the Pole Line Road and Inner Dune Road under this alternative.	season. The Pole Line Road and Inner Dune Route could be considered for flexible management at the discretion of park management, as long as the flexible management threshold (five pairs) has not been exceeded. If piping plovers nest off the Pole Line Road, including in the cobble field, the road would remain open as a 5 mph drive-through section with no pedestrian access until hatching. If, after eggs hatch, the road would be closed except for national seashore essential vehicles and vehicle escorts to the lighthouse in accordance with the USCG/ALF 2007 Race Point Lighthouse Essential Vehicle Management Plan.	Same as alternative A.	Same as alternative B.
Use Restrictions	Fencing and buffers described above would be used to protect shorebird breeding, feeding, or sheltering habitat and activities and achieve the purpose and need as defined in this document (chapter 1). It is not always possible to provide a sufficient buffer to prevent disturbance between nesting or staging/migrating shorebirds and visitors. Therefore, sections of beach may be temporarily closed to various use-opportunities to meet management goals and objectives defined in the purpose and need.			
Use Restriction – Pedestrian	Nesting Shorebirds and Staging/Migratory Shorebirds			
	Where possible, detours would be established to allow visitor access around any closed sections of beach. Additional sections of beach may be temporarily closed if disturbance by visitors is observed.	Same as alternative A.	Same as alternative A.	During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches.

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
<p>Use Restriction – Pedestrian</p>	<p>Piping Plovers, Least Terns, and American Oystercatchers</p>			
	<p>Where beaches are narrow, it is not always possible to provide a sufficient buffer to prevent disturbance between pedestrians and breeding, feeding, and sheltering activities of the piping plover, least tern, and American oystercatcher. Sections of beach might be temporarily closed at times of high tide during the incubation phase of nesting.</p> <p>Pedestrians would be able to access the area at low tide when there is adequate exposed beach. Some sections of beach may need to be completely closed at all tides due to the impractical logistics of staffing and supplies needed for daily replacement of the secondary fenceline washed away at each high tide. Sections of beach may be temporarily closed if visitors (or their footprints) were observed several times a week inside the unstrung secondary fenceline or if there were concerns that day hikers who start at low tide may not be off the beach in time to safely pass the nesting area without disturbing the nesting birds. In all of these scenarios, section of beach may remain closed for an additional one to three days after hatching to protect the newly hatched chicks.</p> <p>In all cases, efforts would be made to provide pedestrian access. Examples of areas at the national seashore that have been</p>	<p>Same as alternative A.</p>	<p>Same as alternative A.</p>	<p>During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches.</p>

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	<p>closed to pedestrian access to protect least terns for the above reasons include: Jeremy Point, Great Island, and Coast Guard Beach in Eastham, Head of the Meadow, Duck Harbor, and Race Point.</p> <p>Pedestrian walkways or access past areas of breeding, feeding, and sheltering may also be temporarily closed or rerouted if incubating piping plovers, least terns, and American oystercatchers are observed leaving their nests (once) when pedestrians walk by. These sections of beach may remain closed for an additional one to three days after hatching to protect the newly hatched chicks. The placement and design of informational/directional signs would be evaluated on a case-by-case basis.</p> <p>Where possible, detours would be established to allow visitor access around any closed sections of beach.</p> <p>On beaches with high visitation, national seashore staff and volunteers may be stationed at closures to explain the closure and provide information on alternative routes.</p>			
Use Restriction – Pedestrian	Staging/Migratory Birds			
	If greater than 100 staging/migrating shorebirds would be regularly observed utilizing the beach habitat, sections of beach	For sections of beach with historic concentrations of staging and migratory shorebirds, pedestrian access to tidal flats and distal tips	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to visitor access

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	with historic concentrations of staging and migratory shorebirds, pedestrian access to tidal flats and distal tips could be restricted from July 15 through October 15.	could be restricted from July 15 through October 15 including, for example: sections of Hatches Harbor / Herring Cove, southern tip of Coast Guard Beach in Eastham, Nauset Marsh and sections of Jeremy Point. For these historic concentration areas, the October 15 date for closures may be extended on a case-by-case basis in the event that large concentrations of staging shorebirds are still using areas after that date.		from March 15–October 15.
Use Restriction – Pedestrian	Hatches Harbor / Herring Cove – Interpretive signs would be installed on the marsh side of Hatches Harbor Spit to discourage beach goers from getting too close to staging birds (generally from July 15–October 15. In addition, at Hatches Harbor, interpretative signs were affixed to buoys mid-channel on the marsh side of the spit in hopes of deterring beach goers from crossing the channel and disturbing flocks of staging shorebirds on the exposed mudflats. Interpretative signs were also placed throughout the marsh at Hatches Harbor / Herring Cove.	Hatches Harbor / Herring Cove – portions would be closed to pedestrians from July to October 15. “Area Closed” signs would be installed throughout the marsh side of Hatches Harbor including the spit and mid-channel (on buoys) on the marsh side and along the northeast corner of Herring Cove to prohibiting beachgoers from getting too close to staging birds and migrating shorebirds resting and feeding on exposed tidal sand flats. These dates may be earlier or later to reflect when the birds arrive or depart on a given year.		
	In other areas throughout the national seashore, when greater than 100 roseate terns, red knots, or mixed flocks of shorebirds have established a use area (i.e., regularly observed for three consecutive days), upper or lower beach protective measures would be implemented to reduce human disturbance.	Same as alternative A.	Same as alternative A.	During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	Upper beach – symbolic fencing with string and “Area Closed – Bird Use Area” signs would be installed around flocks.	Same as alternative A.	Same as alternative A.	life-guarded beaches. During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches.
	Lower beach (intertidal zone) – “Area Closed – Bird Use Area” signs (without string) would be installed guiding pedestrians along the upper beach, around the resting flocks. In all cases, efforts would be made to provide pedestrian access.	Same as alternative A.	Same as alternative A.	During the shorebird season (from March 15 to October 15), all historic shorebird-use areas and other priority habitats, entire sections of beaches (i.e., from bluff toe to waterline), and access points where breeding, feeding, or sheltering activities are observed would be closed to visitor use, except at the six national seashore life-guarded beaches.
Use Restrictions – Motorized and Nonmotorized Boat (including canoes and kayaks) Landing	Nesting Shorebirds and Staging/Migratory Shorebirds			
	Boat landing on the tip of Coast Guard Spit would be evaluated on a case-by-case basis. Sections closed to protect nesting piping plovers, if needed.	A portion of the tip of Coast Guard spit in Eastham would remain open for boat landing at all times, unless future information indicates total closure is warranted.	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to boater access from March 15–October 15.
	Piping Plovers and Least Terns			
Narrow sections of beach that support nesting piping plovers would be temporarily closed to boat landing if the buffer to prevent disturbance, especially at high tide, cannot be attained. Other sections of narrow beach with nesting least terns would be evaluated on a case-by-case basis.	Narrow sections of beach that support nesting piping plovers would be temporarily closed to boat landing if the buffer to prevent disturbance, especially at high tide, cannot be attained.	Narrow sections of beach <u>may</u> be temporarily closed for least terns to boat landings when least terns are	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to boater access from March 15–October 15.

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
		nesting if the buffer to prevent disturbance, especially at high tide, cannot be attained.		
Use Restrictions – Motorized and Nonmotorized Boat (including canoes and kayaks) Landing	American Oystercatcher			
	There may be temporary closures on narrow sections of the southern tip of Jeremy Point. Other sections of narrow beach with nesting oystercatchers would be evaluated on a case-by-case basis.	NPS may temporarily close narrow sections of beach to boat landings when American oystercatchers are nesting if the buffer to prevent disturbance, especially at high tide, cannot be attained.	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to boater access from March 15–October 15.
	Staging Migratory Birds			
	Sections of lower beach (intertidal) areas with greater than 100 staging/migrating shorebirds may be temporarily closed to boat landing.	Boat closures would be established on some beaches for roseate terns, red knots, and other shorebirds as the birds begin to arrive. This closure would protect historically important staging and feeding areas from boat/kayak/canoe disturbance and reduce displacement of the birds from the habitat. Areas that have been important staging/feeding areas for roseate terns and red knots in more than one of the past five years would be pre-closed to boat/kayak/ canoes from July 15 through October 15. A portion of the tip of Coast Guard Spit in Eastham would remain open for boat landing at all times, unless future information indicates total closure is warranted.	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to boater access from March 15–October 15.
Hatches Harbor/Herring Cove – interpretative signs would be installed on the marsh side of Hatches Harbor Spit to discourage boaters from getting too close to staging birds. In addition, at Hatches Harbor, interpretive signs were affixed to buoys mid-channel on the marsh	Hatches Harbor/Herring Cove – Tidal flats along the east side of Hatches Harbor, the northeast corner of Herring Cove would be closed to boat landing between July 15 and October 15. Signs would designate in the mid-channel (on buoys) and between the spit and the marsh. Signs would be installed	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to boater access from March 15–October 15.	

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	side of the spit in hopes of deterring boaters from landing on and disturbing flocks of staging shorebirds on the exposed mudflats. Interpretive signs would be also placed throughout the marsh at Hatches Harbor.	along the perimeter of these flats where needed, including along the northeast corner of Herring Cove. These dates may be earlier or later to reflect when the birds arrive or depart in a given year.		
	No specific management action in this alternative.	Some channels (tidal creeks) in Nauset Marsh, Eastham may be temporarily closed from July 15 through October 15 when there are greater than 100 staging/migrating shorebirds. These dates may be earlier or later to reflect when the birds arrive or depart in a given year.	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to boater access from March 15–October 15.
	No specific management action in this alternative.	Other sections of bay and ocean beaches may be temporarily closed to boats/kayaks between July 15 through October 15 to protect staging and migratory shorebirds if greater than 100 roseate terns, red knots, or mixed flocks of shorebirds are regularly observed using the beach habitat. These dates may be earlier or later to reflect when the birds arrive or depart in a given year.	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to boater access from March 15–October 15.
Use Restrictions – Pets	Pets are required to be on a leash at all times at the national seashore (36 CFR 2.15). Dogs used for hunting would continue to be managed under current regulations (36 CFR 1.5 section 2.15 (b)).			
	Coast Guard Beach (south of pedestrian access) / Nauset Marsh, Eastham, and Jeremy Point would be closed April 1–September 30 (for nesting shorebirds and staging/migratory shorebirds). Beaches that do not have nesting shorebirds or concentrations of staging/migratory shorebirds	Coast Guard Beach (south of pedestrian access) / Nauset Marsh in Eastham, Jeremy Point, Hatches Harbor (including the marsh and spit), and sections of Herring Cove (northwest) would be closed to pets from April 1 through October 15 to protect courting, nesting, and staging/migrating shorebirds. These dates may be earlier or later to	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed from to ORV access from March 15–October 15.

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	would remain open to leashed pets.	reflect when the birds arrive or depart in a given year. Beaches that do not have nesting shorebirds or concentrations of staging/migratory shorebirds would remain open to leashed pets.		
Use Restrictions – Pets	Nesting Shorebirds			
	During the egg phase, pet closures would be posted approximately 200 feet (61 meters) from any nest with eggs or at the ends of any fencing that supports multiple nests.	Pet closures would be posted approximately 200 feet (61 meters) from any posted nesting area where courtship, territorial displays, or nesting, breeding, or feeding are regularly observed.	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to pet and visitor access from March 15–October 15.
	The only exception to this proposed action may be along the ORV corridor where a dog inside a vehicle can pass pet closures to access areas of beach open to pets.			
	When chicks are present, the extent of the closures would be based on a determination of the area used by the chicks with a 164- to 246-foot (50- to 75-meter) buffer applied to each side of that broods area of use until the chicks fledge.	When chicks are present, the extent of the closures would be based on a determination of the area used by the chicks with a 164- to 246-foot (50- to 75-meter) buffer applied to each side of that brood's area of use. These sections of beach would re-open to pets when the post-breeding adults and fledged chicks (including rearing or nursery areas used by unfledged or recently fledged tern chicks) are not seen for five consecutive days.	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to pet and visitor access from March 15–October 15.
	Staging/Migratory Shorebirds			
	The marsh side of Hatches Harbor would be closed to pets until September 30 when there are greater than 100 migratory shorebirds.	Hatches Harbor (including the marsh and spit) and sections of Herring Cove (NW) would be closed to pets from July 15 through October 15.	Same as alternative A.	Same as alternative B.
Additional sections of bay and ocean beaches may be temporarily closed to pets as needed to protect staging and migratory shorebirds if greater than 100 shorebirds are regularly	Additional sections of bay and ocean beaches would be temporarily closed to pets between July 15 through October 15 to protect staging and migratory shorebirds if greater than 100	Same as alternative A.	All beaches (upper and lower beaches to the water) with historic shorebird use and suitable habitat would be closed to pet and visitor access from March 15–October 15.	

TABLE G-1. COMPARISON OF ALTERNATIVES MATRIX

Alternative Elements	Alternative A (no action)	Alternative B (NPS preferred alternative)	Alternative C	Alternative D
	observed.	roseate terns or red knots or other shorebirds are regularly observed using the beach habitat. Areas would be monitored and closures may be lifted if no concentrations of staging birds are using the area for five consecutive days. The October 15 date for closures may be extended on a case-by-case basis in the event that large concentrations of staging/migrating shorebirds are still using national seashore areas after that date.		
Use Restrictions – Aerial Recreational Activities	Nesting Shorebirds and Staging/Migratory Shorebirds			
	All aerial activities including, for example, hand-held kites, remote/radio-controlled planes, and para/hang gliding would be prohibited above and within 656 feet (200 meters) of posted shorebird use areas and on life-guarded beaches.			
	Kiteboarding/kitesurfing is prohibited on all open waters on ocean and bayside March 15–October 15, except a small section of beach owned by the Town of Wellfleet at Duck Harbor (if greater than 656 feet (200 meters) away of posted shorebird use areas) where kite surfers can launch their kites and take a direct route, 0.25 mile offshore, outside the national seashore boundaries.	Same as alternative A, but adds para/hang gliding ban within national seashore from March 15–October 15.	Same as alternative A. In addition, a total ban on kite boarding / surfing throughout the national seashore.	Same as alternative B.
Predator Management	Nonlethal methods (predator exclosures, tern shelters), refuse management, education would be used.	Same as alternative A plus managing predator impacts by selective lethal removal of avian and mammal predators (targeting individual animals in documented priority shorebird sites with consistent history of low productivity due to predation and evaluated on a yearly basis) (Integrated Predator Management Plan) and possible use of electric fencing.	Same as alternative B.	Same as alternative A.

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GLOSSARY AND ACRONYMS

Affected Environment	A description of the existing environment to be affected by the proposed action (40 CFR 1502.15).
Alternative	A reasonable way to fix an identified problem or satisfy a stated need (40 CFR 1500.2).
Aquatic	Growing in, living in, or dependent on water.
Benthic	Living at, in, or associated with structures on the bottom of a body of water.
Biological Opinion	A document that is the product of formal consultation, stating the opinion of the USFWS on whether or not a federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.
Breeding	Mating and production of offspring by animals.
Breeding Habitat	Habitat used by migratory birds or other animals during the breeding season.
Buffer	An area surrounding a sensitive resource limiting visitor use.
Candidate Species	Species for which we have sufficient information on file about their biological vulnerability and threats to propose listing them as threatened or endangered.
Community	The locality in which a group of people resides and shares the same government.
Community Type	A particular assemblage of plants and animals, named for its dominant characteristic.
Conservation	Managing natural resources to prevent loss or degradation; includes sustainable use, preservation, restoration, and enhancement.
Consultation	All federal agencies must consult with the US Fish and Wildlife Service (or National Marine Fisheries Service) when any activity permitted, funded, or conducted by that agency may affect a listed species or designated critical habitat, or is likely to jeopardize proposed species or adversely modify proposed critical habitat. There are two stages of consultation: informal and formal.
Critical Habitat	According to US federal law, the ecosystems upon which endangered and threatened species depend.
Database	A collection of data arranged for ease and speed of analysis and retrieval, usually computerized.
Degradation	The loss of native species and processes such that only certain components of the original biodiversity persist, often including significantly altered natural communities.
Disturbance	Any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment.

Ecosystem	A natural community of organisms interacting with its physical environment, regarded as a unit.
Ecological Integrity	Ecological integrity refers to the health of an ecosystem. If a system has integrity, it is fully functional with all its key biotic and abiotic processes intact.
Endangered Species	A federally listed (under the Endangered Species Act) or state listed protected species in danger of extinction throughout all or a significant portion of its range.
Endemic	A species or race native to a particular place and found only there.
Enabling Legislation	National Park Service legislation setting forth the legal parameters by which each park may operate.
Endangered Species Act	An Act to provide a means whereby the ecosystem upon which endangered and threatened species depend may be conserved and to provide a program for the conservation of such endangered species and threatened species.
Environmental Assessment	A public document that discusses the purpose and need for an action, its alternatives, and provides sufficient evidence and analysis of its impacts to determine whether to prepare an environmental impact statement or a finding of no significant impact (40 CFR 1508.9).
Environmental Consequences	Environmental effects of project alternatives, including the proposed action, any adverse environmental effects which cannot be avoided, the relationship between short-term uses of the human environment, and any irreversible or irretrievable commitments of resources which would be involved if the proposal should be implemented (40 CFR 1502.16).
Estuaries	Deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from land.
Executive Order	Official proclamation issued by the president that may set forth policy or direction or establish specific duties in connection with the execution of federal laws and programs.
Exotic Species	A species that is not native to an area and has been introduced intentionally or unintentionally; not all exotics become successfully established.
Extinct	A species no longer in existence.
Extirpated	Status of a species or population that has completely vanished from a given area but that continues to exist in some other location.
Federal Land	Land owned by the citizens of the United States and managed for the public by federal government, including national forests, national parks, and national wildlife refuges and others.
Federally Listed Species	A species listed either as endangered, threatened, or a species at risk (formerly, a "candidate species") under the Endangered Species Act of 1973, as amended.
Finding of No Significant Impact	Supported by an environmental assessment, a document that briefly presents why a federal action will have no significant effect on the human environment, and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).

Fledge	The stage in a chick's life when the feathers and wing muscles are sufficiently developed for flight. It also describes the act of raising chicks to a fully grown state by the chick's parents.
Floodplain	Flat or nearly flat land that may be submerged by floodwaters; a plain built up or in the process of being built up by stream deposition.
Geographic Recovery Area	Provides a framework within which protection and population establishment efforts can be ranked and implemented.
Grassland	A habitat type with landscapes dominated by grasses.
Groundwater	Water in the ground that is in the zone of saturation, from which wells and springs and groundwater runoff are supplied.
Habitat	The place where a particular type of plant or animal lives that provides all of the basic requirements for life.
Harass	An intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly impair normal behavioral patterns including breeding, feeding or sheltering.
Harm	An act which actually kills or injures wildlife. Such acts may include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering.
Incidental Take Statement	A term referring to that part of a biological opinion that exempts incidental take of a listed species from the Section 9 prohibitions.
Integrated Predator Management	Sustainable approach to humanely managing predators by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks.
Intertidal	The area of land along a shoreline that is exposed to air during low tide but covered by water during high tide.
Invasive Species	An alien species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
Invertebrate	Any animal lacking a backbone or bony segment that encloses the central nerve cord.
Issue	Any unsettled matter that requires a management decision (e.g., an initiative, opportunity, management problem, threat to the resources of the unit, conflict in uses, public concern, or presence of an undesirable resource condition).
Landform	The physical shape of the land reflecting geologic structure and processes of geomorphology that have sculpted the structure.
Landscape	An aggregate of landforms that may occur at multiple scales of interest, together with its biological communities.
Listed Species	A species, subspecies, or distinct vertebrate population segment that has been added to the federal lists of endangered and threatened wildlife and plants as they appear in sections 17.11 and 17.12 of Title 50 of the Code of Federal Regulations (50 CFR 17.11 and 17.12).
Local Agencies	Generally, municipal governments, regional planning commissions, or conservation groups.

Management Plan Marine	A plan that guides future land management practices on a tract. Of or relating to the sea.
Memorandum of Understanding	A document that describes an agreement between partners where a set of expectations, actions or commitments are agreed upon.
Migratory Birds	Species that generally migrate south each fall from breeding grounds to their wintering grounds and vice versa in the spring.
Mitigation	Actions to compensate for the negative effects of a particular project (e.g., wetland mitigation usually restores or enhances a previously damaged wetland or creates a new wetland).
Monitoring	The process of collecting information to track changes of selected parameters over time.
National Wildlife Refuge	National Wildlife Refuge is a designation for certain protected areas of the United States managed by the US Fish and Wildlife Service.
Native	A species that other than as a result of an introduction historically occurred or currently occurs in a particular ecosystem.
Native Plant	A plant that has grown in the region since the last glaciation, and occurred before European settlement.
Natural Disturbance Event	Any natural event that significantly alters the structure, composition, or dynamics of a natural community: e.g., floods, fires, and storms.
Necropsy	A dissection of the dead body of an animal to determine the cause of death.
Nonnative Species	See exotic species.
Objective	A concise, quantitative (where possible) target statement of what a plan will achieve. Planners derive objectives from goals and they provide the basis for determining management strategies. Objectives should be specific, measurable, attainable, relevant, and time-specific.
Partnership	A contract or agreement among two or more individuals, groups of individuals, organizations, or agencies, in which each agrees to furnish a part of the capital or some service in kind (e.g., labor) for a mutually beneficial enterprise.
Plant Community	A distinct assemblage of plants that develops on sites characterized by particular climates and soils.
Preferred Alternative	The alternative determined by the decision-maker that best achieves the NPS purpose, vision, and goals; contributes to the NPS mission; addresses the significant issues; and is consistent with principles of sound fish, wildlife, and ecosystem management.
Productivity	Amount of production over a given period of time (e.g., chicks produced per year).
Protection	Mechanisms that ensure land use and land management practices will remain compatible with maintaining species populations and ecological integrity at a site.
Public	Individuals, organizations, and nongovernment groups; officials of federal, state, and local government agencies; American Indian tribes, and foreign nations.

Public Involvement	Offering an opportunity to interested individuals and organizations whom actions or policies may affect to become informed; soliciting their opinions. Public input is given thoughtful consideration in shaping decisions about managing CCNS.
Public Land	Land owned and/or managed by the local, state, or federal government.
Rare Species	Species identified for special management emphasis because of their uncommon occurrence.
Recovery	The process by which the decline of an endangered or threatened species is arrested or reversed or threats to its survival neutralized so that its long-term survival in nature can be ensured.
Recovery Plan	A document drafted by the Service or other knowledgeable individual or group, that serves as a guide for activities to be undertaken by federal, state, or private entities in helping to recover and conserve endangered or threatened species.
Recovery Unit	Management subsets of the listed species that are created to establish recovery goals or carrying out management actions. To lessen confusion in the context of Section 7 and other Endangered Species Act activities, a subset of an animal or plant species that needs to be identified for recovery management purposes will be called a “recovery unit” instead of a “population.”
Runoff	Water from rain, melted snow, or agricultural or landscape irrigation that flows over a land surface into a water body.
Socioeconomic	Social and economic conditions and their interplay.
Special Status Species	Federal or state listed as threatened or endangered species and others not listed, but about which we or our partners are concerned.
Staging Area	Habitat used during bird migration for resting, feeding, and/or congregating.
Stakeholder	Individuals, groups, organizations or agencies representing a broad spectrum of interests including, for example, personal, business, tourism, conservation, recreation, and historical perspectives.
State Agencies	Agencies of state governments.
State Listed Species	A listing process to identify endangered, threatened or species of concern in a specific state. These species may or may not be federally listed but the population is in decline.
Status Assessment	A compilation of biological data and a description of past, present, and possible future threats to a species.
Strategy	A specific action, tool, technique, or combination of actions, tools, and techniques for meeting objectives.
Take	From Section 3(18) of the Federal Endangered Species Act: “The term ‘take’ means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.”
Terrestrial	Of/or pertaining to land.

Threatened Species	A federally listed (under the Endangered Species Act), protected species that is likely to become an endangered species in all or a significant portion of its range.
Trust Resource	A resource that the government holds in trust for the people through law or administrative act. A federal trust resource is one for which responsibility is given wholly or in part to the federal government by law or administrative act. Generally, federal trust resources are nationally or internationally important no matter where they occur, like endangered species or migratory birds and fish that regularly move across state lines. They also include cultural resources protected by federal historic preservation laws, and nationally important or threatened habitats, notably wetlands, navigable waters, and public lands like state parks and national wildlife refuges.
Upland	Dry ground (i.e., land lying above the level where water flows).
Wetlands	Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. These areas are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted to life in saturated soil conditions.
Wildlife Management	Manipulating wildlife populations, either directly by regulating the numbers, ages, and sex ratios harvested, or indirectly by providing favorable habitat conditions and alleviating limiting factors.

ACRONYMS AND ABBREVIATIONS

ALF	American Lighthouse Foundation
APHIS	Animal and Plant Health Inspection Services, US Department of Agriculture
BBS	Breeding Bird Survey, North American
CBC	Christmas Bird Count, National Audubon Society
CCNS	Cape Cod National Seashore
CFR	Code of Federal Regulations
cm	centimeter
DRC-1339	3-chloro-4-methylbenenamine hydrochloride
EA	Environmental Assessment
EPA	US Environmental Protection Agency
ESA	Endangered Species Act of 1973
FONSI	Fish and Wildlife Coordination Act of 1956
FY	fiscal year
GIS	geographic information system
GMP	General Management Plan
GPS	global positioning system
HCP	Habitat Conservation Plan
MA	Massachusetts
MADFW	Massachusetts Division of Fish and Wildlife
MBTA	Migratory Bird Treaty Act of 1918
MDFG	Massachusetts Department of Fish and Game
MESA	Massachusetts Endangered Species Act
MNWR	Monomoy National Wildlife Refuge
MPH	miles per hour
NAS	National Audubon Society
Neg Regs	Negotiated Regulations
NEPA	National Environmental Policy Act of 1969
NHESP	Natural Heritage & Endangered Species Program
NPS	National Park Service
NWR	National Wildlife Refuge
ORV	off-road vehicle
OSV	over-sand vehicle
SCV	self-contained vehicle
SHPO	State Historic Preservation Office
TTOR	The Trustees of Reservations
USC	United States Code
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

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